AMERICAN MACHINIST

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Scott Printing and Folding Machine.

Of late years great improvements have been made in machinery for the production of newspapers, and especially what is termed "Rotary Web Perfecting Presses."

On this page we present to our readers a view of what is claimed to be the fastest perfecting press in use, viz.: The Scott Printing and Folding Machine, manufactured by C. Potter, Jr., & Co., New York.

In 1872, Walter Scott, of Chicago, conceived the idea of producing from a roll or web of paper complete copies of a newspaper, printed, folded, pasted, and cut in book form (in the same style as the AMERICAN MACHINIST is now presented to the public), at one operation. Shortly afterwards he made a machine which is said to have produced that result in a very satisfactory manner, at a speed of 9,000 copies per hour. The first newspaper which adopted this convenient style was the Chicago *Inter-Ocean;* since that time most of the principal Western papers and a few of the Eastern also appear in this form. The machine here shown is Mr. Scott's latest effort in this direction, with what degree of success will be apparent when it is stated that the first machine of the kind made, now in use by the Chicago *Herald,* has produced in one hour, printed, cut, folded, and counted in bundles of 50, the enormous quantity of 18,000 eight-page papers, equivalent to 36,000 four-page papers. This is a single press using only one form of a kind; the double press producing twice that amount, or 36,000 complete copies of eight pages per hour.

As will be seen from the engraving the roll of paper is placed at the end of the machine, so that it can be easily slid into its bearings without lifting; the web passes over above the ink-distributing rollers (where it is cut longitudinally in the center,) to the first plate and impression cylinders, where it is printed on one side. It then passes up between the first and second impression cylinders and to the second plate cylinder, where it is printed on the opposite side. The web thus printed and cut passes over a turner placed at an angle of 45°, thus causing the sheet to run at right angles to its former course, and down to the cutting and folding cylinders. These cylinders are placed at right angles to the printing cylinders, and adjusted so as to cut the webs at the marginal portion left unprinted by the printing cylinder, and also to fold the sheets thus cut two times. The twice-folded sheets then pass along tapes to be subsequently folded by two sets of creasers and rollers. These creasers are driven by an eccentric, which in turn is driven by eccentric gearing. This device gives the creaser a quick motion, when acting on the sheets, and also a continuous motion, which is much better and can be worked faster than the usual cam movement.

When the sheets are thus folded, the one nearest the end of the machine falls into the receiving trough; the other travels along tapes, which are so timed as to cause it to meet the following sheet at the same point of delivery. The two sheets are thus delivered together in the receiving trough, when by a very ingenious and simple contrivance they are counted into bundles of 25, 50 or 100 copies each.

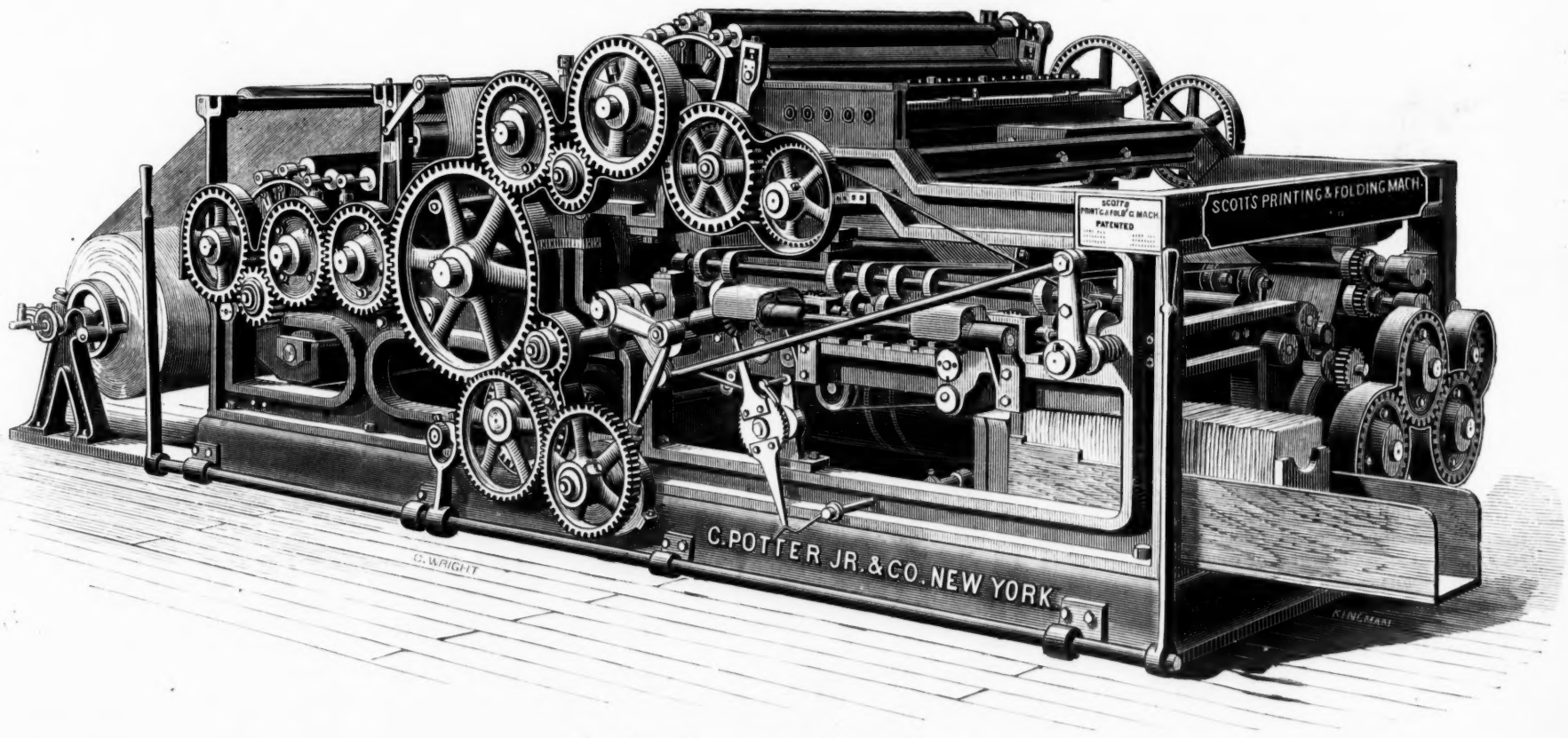
This counter consists of a ratchet wheel and catch, shown at the front of the press.

There are two arms or projections, one at each side of this wheel, so that in revolving they come in contact with a tripping device, which throws up every 25th, 50th or 100th paper a few inches above the others as they are counted.

In this way much time is saved in counting out the papers after they are delivered from the press. When an eight-page paper is wanted, one-half of the web is turned over a second turning bar, placed in front of the one previously mentioned. This causes the one-half of the web to overlap the other; both webs then pass through the cutting and folding cylinder, as before mentioned, and are cut and folded together as one product, the paste having been applied before the two sheets came into contact. In the same manner a twelve-page paper can be produced by the same machine.

Among the advantages claimed for this machine are these: It is easily handled, all parts being conveniently reached from the floor; the roll of paper does not require to be raised; the inking rollers are all in view, and can be easily adjusted; the papers are printed, pasted, cut and folded twice without the use of tapes; all the principal movements are rotary, and consequently can be run at a high rate of speed; a set of plates can be put on without moving the press; there is no complication of switches, flying cams, small gearing, tape pulleys or intricate parts, which wear out and cause the sheets to choke up the machine.

The whole machine, including the roll of paper, is only fourteen feet long and four feet high, and weighs about ten tons; the cost is $18,000.



THE SCOTT PRINTING AND FOLDING MACHINE.

The Dayton (Ohio,) Iron and Brass Works, in order to allow their industrious apprentices to observe the time of day without the unpleasant necessity of leaving their work, have provided for their use a clock with a six-foot dial.

Cold Swaging.

BY S. W. GOODYEAR.

What is cold swaging? How does it differ from cold rolling, or from wire drawing in its effect upon metals and alloys? are questions which open up a wide field for investigation. It is generally conceded that rolling, drawing, hammering, or working metals or alloys in a cold state, by any of the ordinary methods, has the effect of very rapidly hardening the articles operated upon, necessitating a succession of annealings, if a considerable reduction or change of shape is required to be made. To neglect to re-anneal after the limit is reached, not only brings ruin to rolls, or dies, but to the work as well. Take wire drawing as an illustration. Suppose a wire rod of steel, as it leaves the rolls, of $\frac{5}{8}$" diameter. To make a finished wire of $\frac{5}{16}$" diameter will require twice annealing. To continue reducing this $\frac{5}{16}$" wire until a diameter of $\frac{1}{16}$" is reached will involve still eight additional annealings, making ten operations of annealing in drawing from the rough-rolled rod of $\frac{5}{8}$" diameter, or "two ought," as the wire drawer will call it, to number 16, or $\frac{1}{16}$" diameter finished wire.

Does some wire drawer say it can be drawn more than $\frac{1}{8\,9}$" on an average at each successive annealing? If so, increase the amount to $\frac{1}{16}$" as an average per each drawing, and then five annealings will be necessary. Very nearly the same results will be reached by rolling in a cold state between rolls provided with grooves of suitable shape to produce either round work, or such other shapes as it is possible to make in this way. More violent modes of cold working, as under a drop, or hammer, will, where the impact is of considerable force, harden the work operated

upon still more in proportion to the amount of reduction. Under this rule the smith hammer-hardens springs, and sometimes has the mishap, if he continues the hammering too long, to produce sundry cracks, at the same time hardly reducing the section of the piece upon which his blows fall. In considering the peculiar process known as cold swaging, it will be found that the rod of $\frac{3}{8}$" diameter, even if it be of tool steel, carrying a high percentage of carbon, can be as readily swaged down by successive operations to number 16, or $\frac{1}{16}$" at one annealing, or by re-annealing once, making but two annealings in all, as by the drawing or rolling methods with five or ten annealings respectively, as mentioned above. It will be found further, that articles may be swaged in this manner and remain sound and perfect, which would, by the rolling process, become split and of no value.

It is a fact in many cases, that metallic articles are made much more tough by swaging. As an instance tending to prove this, in many cases in which drawn wire was required to bend to a certain shape. and at least, fifty per cent. would break before reaching the desired angle, the breakage has been reduced to less than five per cent. by simply swaging the wire sufficiently to reduce the diameter $\frac{5}{1000}$". Not wishing to tire the reader with that which from long familiarity has become a hobby, perhaps, with the writer, it will be sufficient, possibly, to draw from some abler pen, reasons why, by asking these questions: Why does not cold swaging harden the metal or alloys acted upon, in as great degree as does drawing or rolling? Why does cold swaging, within a reasonable limit of reduction actually add to the malleability and toughness of articles so reduced? The first question, from the mechanic's point of view, may be answered thus: The operation of swaging is not violent, the reduction is not made by heavy impact, nor by any force applied in a direction which, if carried to an extreme, would tear the metal asunder, or burst it open by unequal pressure, but, on the contrary, the successive compressions, *not blows*, follow each other so rapidly, that each in itself has but a very slight part of the aggregate reduction to make. Acted upon by a tremendous pressure, the metal is still required to yield but little at once, and gradually assumes a new shape and size without the partial disintegration and accompanying hardness attending those processes which violently force the parts composing the mass upon each other, in a way to get up excessive internal friction.

The second question may be answered thus: The apparent increased toughness is due in part to the gentleness of the process, as described above, but, in a great measure, is due to the fact that all parts of the metal acted upon receive the same degree of condensation, leaving no unequal strains, which, by their conflicting forces, tend to weaken in many cases articles reduced by other methods. In the case of swaging, the pressure comes practically upon all parts of the circumference at each compression, and with each compression the entire mass acted upon is moved to the very center. By each pulsation of the swaging process, the piece operated upon, becoming smaller, is forced by elongation into a hole of continually decreasing size up to the time the pressure ceases, and the dies retreat to allow the work to be advanced for another squeeze.

Judging from the following, the editor of the Jersey City *Evening Journal* has been taking a trip on the Fontaine locomotive:

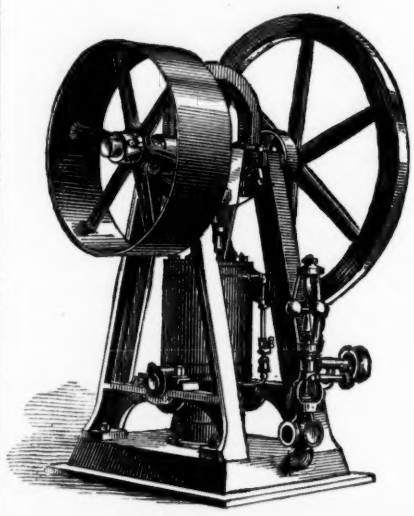
The new-fangled locomotive with wheels all over it, and which was to run 90 miles an hour without half trying, is a failure. It is able to make this tremendous speed, but it doesn't do to handicap it with any dead weight such as cars, tender or a plump engineer. Besides it needs 63 miles to get under full headway, and 30 miles in which to stop. In going around a curve it is necessary to stop and spit on its hands, and take it altogether, the new idea doesn't pan out well. After all, there is no superior to the ordinary engines which have been in use for years, and which have a wholesome way of attending strictly to business and making good time.

Vibrating Valve Engine.

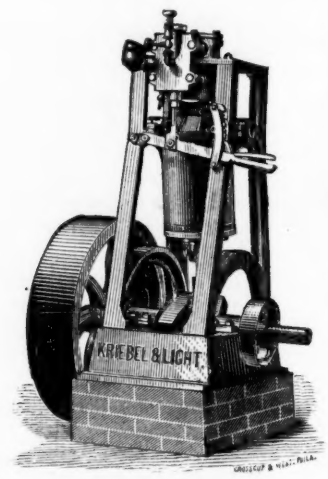
Owing to defects that are well known to engineers, the oscillating cylinder engine has, generally speaking, not been well received; while this type of engine has been properly considered to possess valuable features—such as simplicity of construction by reducing the number of the parts,—it has generally been considered that the defects, in the majority of instances, have outweighed the advantages.

We present with this, engravings of four different styles of a steam engine manufactured by the West Point Engine and Machine Co., of West Point, Montgomery County, Pa. These engines are styled the Kriebel vibrating-valve engine, and are designed to do away with the more serious objections to the ordinary oscillating steam engine.

The peculiarly distinctive feature of these

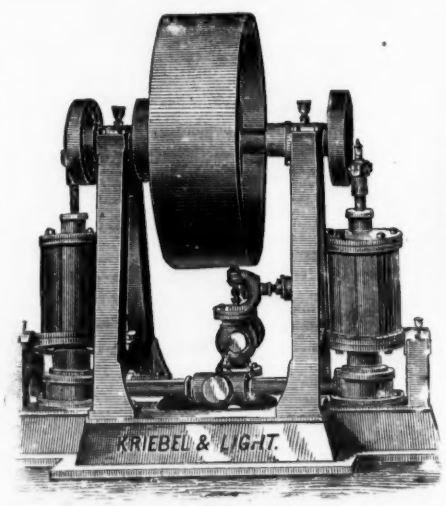


Stationary Engine.

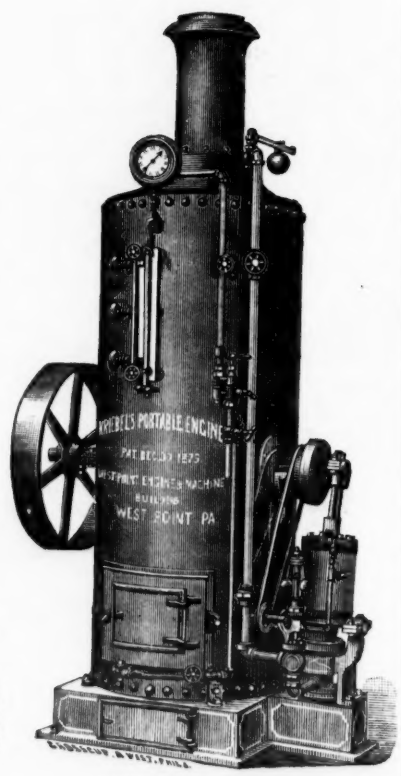


Launch Engine.

engines is the valve motion, which is substantially the same in all the four styles illustrated. Referring to the engravings, (with the exception of the launch engine, in which the arrangement is somewhat modified to provide for reversing the motion), it will be seen that the cylinder oscillates on trunnions situated near the bottom end. These trunnions are simple solid projections, finished accurately



Twin Engine.



Portable Engine.

in truth with the bore of the cylinder. These projections or trunnions, not being used for the induction or eduction of steam, are made of a suitable size for the purpose, and are as easily kept in proper condition as any other journal, while they are open to none of the objections of leaky joints. These trunnions run in rigid bearings, and are of ample proportions.

The bottom of the cylinder, which is provided with three ports, substantially the same as the ports in the valve seat of an ordinary slide valve engine, is finished from the centers of the trunnions. Below the cylinder is situated what may be called the valve box, in which is the valve, operated in connection with these ports. This valve, which is, of course, stationary (the ports being covered and uncovered by the oscillation of the cylinder), is extended downwards in the box in the form of a steam pipe, connecting with the interior of the valve proper, and with the steam pipe from the boiler. Through this extension of the valve the steam enters the interior of the valve, and is distributed to the top and bottom of the cylinder.

The exhaust steam is discharged into the steam box, and is conducted away in the ordinary manner. It will be seen that there is nominally no pressure of the valve to the seat; and, for the purpose of keeping the necessary contact between the two, a spring of sufficient tension is employed. By this means the valve is, to all intents, a balanced slide, and the injurious effect of excessive and unequal pressure is avoided. This insures freedom from cutting, the least possible loss from friction, and a constant tendency to increased tightness. It also makes instantly visible any leak that may occur—a matter of no little importance.

In the stationary engine the fly wheel is situated on one side of a solid steel center crank, and the band wheel is situated on the other side.

In the portable engine the boiler is made of the best charcoal hammered iron, and is set on a cast-iron base, to which the engine is fastened. In order to equalize the strain on the boiler, an oblong tube passes through and across the boiler, and through this tube passes the crank shaft. On one side of the crank shaft is fastened the crank wheel, and on the other the band wheel. Substantial boxes on either side carry the crank shaft.

The twin engine represents the arrangement where two cylinders are used.

In the launch engine a modification is required—as previously intimated—to provide for reversing; but the entire arrangement is such that but one lever is required for starting, stopping and reversing.

In all these engines a guide rod, arranged to pass up through an adjustable box, relieves the piston rod from the ordinary injurious side wear.

There is, of course, with this engine no eccentric and rod, nor cross head and connecting rod to get out of order, or to require attention.

Artificial Water Supply in the Far West.

The White Mountain Water Company of Nevada (Esmeralda County) has just completed its 25 miles of pipe line and is now selling water for hoisting, mining and domestic purposes to the extent of $300 per day. The water is brought by its own pressure from mountain springs, passing over Miller Mountain in transit. Heretofore water has been peddled by private teamsters to such of the Nevadians as allowed themselves to get thirsty (for water) at the rate of four to five cents a gallon. The new company, which is largely composed of New York capitalists, is putting money in its purse by the wholesale supply of water at a very much lower rate. Generally in the far West it has not been usual to supply water in this way for irrigating purposes, but in some districts, doubtless, attention may profitably be turned in this direction. The Abendroth & Root Manufacturing Co., of New York, who supplied the spiral wrought iron pipe used by the White Mountain Company, mention instances in which artesian wells have been bored in Southern Nevada a depth of 2,000 feet, the prospect of striking water appearing to diminish with the depth. In Arizona and New Mexico, and in portions of Colorado, a similar difficulty is experienced, the only hope of supplying water seeming to lie in bringing an artificial supply from the mountains.

The Milling Machine.

It is always a question of time for any machine, however perfect, to work its way into use in manufacturing establishments. We were reminded of this, a few days since, by observing that the proprietors of one of our young and enterprising machine-tool manufactories are arranging to do with the milling machine, in some instances, the entire work on certain sizes of machine tools, that has previously been done on the planer. They are satisfied that the work can be better done in this way; that with properly-constructed cutters the work of the milling machine is done more accurately to standard size than is practicable with the planer; and they have demonstrated by actual trial that certain parts of the work, upon which planer work has hitherto been thought indispensable, can be done with a milling machine at a mere fraction of the cost.

This is only a single instance, but it leads to the belief that the milling machine, as an economical tool in machine production, is by no means appreciated as it should be. That it has not come into more general use is due to the fact that it is a hard, slow process to change current opinion.

A great many mechanics who are impressed with the idea that the milling machine is only adapted to the use of narrow cutters, thus precluding the possibility of operating on surfaces of considerable extent by a single process, might learn something to their advantage by witnessing the operation of some of the large, splendid tools of this class, designed for heavy work.

Another point upon which considerable misconception prevails is in relation to the durability of the cutters used with this tool. A very general opinion seems to be that the cutters are not only costly to make, but that they will last but a short time. In relation to the first of these ideas—the cost—with proper arrangements for making, the cutters are by no means so expensive to make as might be supposed. With reference to the second—the length of time they will last—those who are not familiar with their use would undoubtedly be greatly surprised were they to extend their observations in this respect. In point of fact, the facility with which the milling cutter removes a large amount of metal, by its continuous operation

on extended surfaces, does not render advisable a high speed, or, in other words, the large amount of work that can be got over by the *use* of the milling machine is generally so satisfactory there is little inducement to *abuse* the cutters by excessive speed. But the most important feature in this respect is the fact, that the direction of the cutter is such as to keep the cutting edges almost literally out of contact with the scale or skin of the metal being operated upon. From this, and from the fact previously intimated — that there hardly exists the inducement to crowd the speed, — the length of time that the cutters (which of course should be made of the best material) will last is remarkable.

Another important feature of the milling machine is the immense variety of work that may be done with one. With reference to this, it may almost be said that the greatest difficulty is to find what *cannot* be done with this tool.

That the use of the milling machine is an efficient aid in assisting a shop to keep its work to standard sizes, especially such work as is somewhat irregular in form, is apparent. The ease with which irregular surfaces may, by a proper adaptation of cutters, be produced and reproduced, when compared with the tediousness and final uncertainty of other processes, not only cheapens production, but renders it easier to make any number of pieces alike than to make them unlike. On such work the milling machine does its own gauging and measuring, and comes nearer, when required, to doing its own finishing than most other machine tools.

Taken altogether, it is a fact that a large percentage of mechanics have but little conception of the milling machine in its present construction; and in many instances, where it is in use, the variety of purposes for which it is available is by no means appreciated.

The *Hour* (N, Y.), says: "The first steamer from New York to Odessa and Sebastopol sailed on March 1. The cargo consisted almost entirely of agricultural machinery. Russia is the great rival of the United States in the production of wheat, and the husbandmen of that country have just begun to avail themselves of the reaping, mowing, plowing and other machines which have done so much to save labor and increase production in this country. The English have had a monopoly of this trade in American agricultural machinery, but it has been found that a great deal of money can be saved by shipping to Russia directly.

New Style of Punch for Steel and Iron Plates.

The accompanying engraving, Fig. 1, represents a new form of punch for punching either iron or steel plates, made by R. E. Dietz, of 56 Fulton street, New York. At first it may appear to some that this is the same style of punch which was made some years ago by the inventor, Samuel H. Jenkins, of this city. The reader, however, conversant with that punch, will see at once from this description that such is not the case. This punch, as shown at *A*, is first turned up to the desired finished size to fit the die *B*, the same as in making ordinary punches. Then, by a special attachment to the lathe, a peculiar shoulder is turned upon the punch, as shown at *C*, leaving two high edges and two depressed edges exactly opposite each other. The object of this arrangement is to punch and ream a hole perfectly parallel at one operation. It is accomplished in the following way: The lower part of the punch passes through the iron, and pushes out the wad, after which the cutting edge around the sides passes through and trims the hole moothly to an exact standard size.

It has been known for years past that the common punch in general use has a very damaging effect upon the iron and steel plates punched by it. For instance, in punching holes for ¾-inch rivets through iron plate ½ inch thick, the diameter of the hole on the lower side of the sheet will be generally from $\frac{1}{16}$ inch to $\frac{3}{32}$ inch larger than the punch.

In punching common iron with the ordinary punch, the iron will be torn so as to leave sharp, ragged edges in the hole, as shown at *B*, in Fig. 2, *A* representing a ¼-inch plate engraved full size. The reader will observe a sharp offset or rag near the middle of the sheet, showing that the grain of the iron has been disturbed for a distance of about ⅛ of an inch all round the hole.

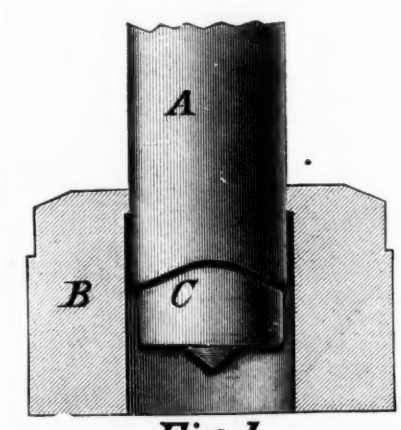


Fig. 1.

C represents a hole punched with the new form of punch shown in Fig. 1, in which the sides of the hole will be found parallel. Another distinguishing feature of this hole is that the surface of metal in the hole is condensed, so that it is much harder, and will resist the shearing action of excessive strain upon the rivet even longer than drilled plates, the punching involving much less expense than drilling.

This is owing to the fact that a drill does not condense the metal, neither does it cause a flow as is the case with the Jenkins punch. In proof of this statement specimens were cut from the same sheet and tested. One specimen was drilled and riveted while another was punched and riveted. These specimens were then pulled apart in a reliable testing machine with the following results: Drilled specimen gave way, or sheared with a strain of 39,210 pounds, and the one punched with the Jenkins punch at 39,850, while another punched with the common punch sheared with a strain of 38,820 pounds.

The specimen here shown is from actual practice.

The iron was first punched, then cut through the centers of the holes. The edges were then finished and etched with acid to show the grain of the iron. A specimen of riveted joint is shown in Fig. 3. It is always desirable to put the small diameters of the holes together when possible, but in boiler work at least one-third of the work must be put together, as shown at *F*; then when the rivet *D* is driven it does not fill the hole, but leaves an open space at the edge of the sheet where they touch each other. This is the very place where the rivet ought to fill the hole to resist the slightest yielding to produce a shearing action upon the rivets.

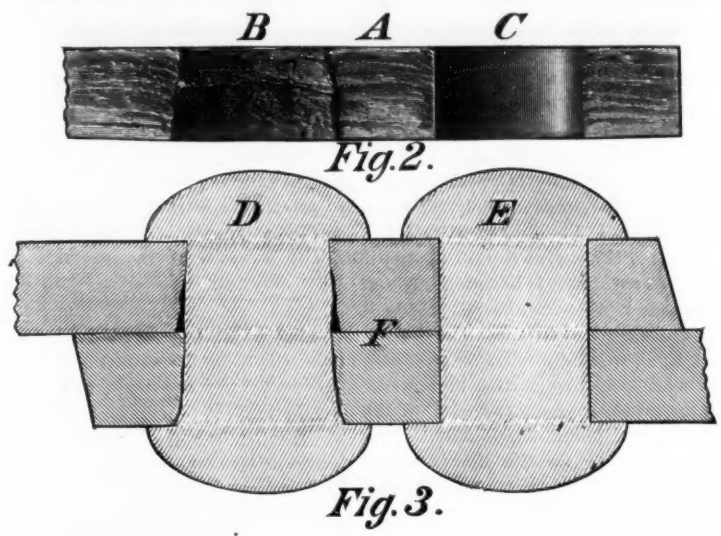


Fig. 3.

The rivet *E* is driven in the hole made by the new punch and as the sides are parallel it does not matter which side the punch enters. The only care necessary is in accurate spacing of the holes before punching. In this case the rivet fills the hole from end to end.

The difference between the original punch made by Mr. Jenkins and the one shown in Fig. 1 is, in the former the cutting edges of the offset or reaming part instead of being one continuous curved line, as shown, were shaped like a clutch, having two teeth at opposite sides, with square edges. The effect was that the cutting edges became broken, and the pitch of the teeth had a tendency to rotate and loosen the punch. In the latter there are two high edges at opposite sides, and similarly two low edges, so that there is no force exerted to twist the punch.

The cutting edge is beveled so that it not only cuts but condenses the metal as the punch passes through the hole.

We have witnessed the practical working of this punch and and were very much pleased with the ease and accuracy with which it perforated plates of one-half inch in thickness.

Shop Kinks.

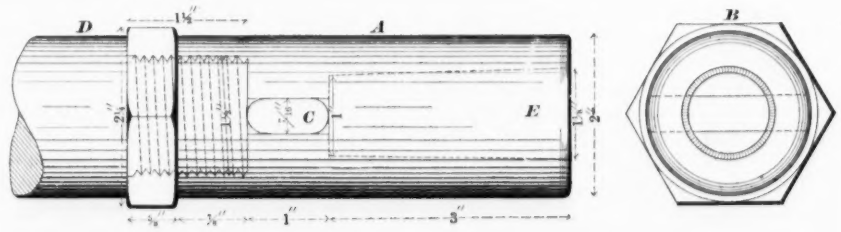
No. 28.

BY L. F. LYNE.

STANDARD SOCKET FOR DRILL PRESSES.

When a new drill press is required in a shop, the proprietor generally selects from the stock in the market, without considering the fact that the new press will compel him to make or purchase a special set of drills, as the drills used in the shop will not fit.

A great many shops have a set of drills for each drill press, which is found to be a serious annoyance, particularly where many special tools are used upon drill presses. I believe it to be more economical to have one set of drills fit any press in the shop. I am aware, of course, that this is done with twist drills, but I mean this to apply to the common flat drill, in particular.



STANDARD SOCKET FOR DRILL PRESSES.

In a certain shop there were six drill presses, each of which had its own particular set of drills. Instances frequently happened where a workman wished to drill a piece of work, which could be done only under one of the six presses. The press being occupied, he had to wait until the former workman had completed his work, or have the foreman put him out.

One day after hearing several grievances from the workmen in reference to drill presses, I concluded to make one set of drills fit all the presses. I had a reamer made to fit the socket of a new press which had recently been purchased. The spindle was removed and placed in a lathe. By holding it in a steady rest, the hole for the drill was "just cleaned up" with the new reamer.

One or two of the spindles in the other presses had holes sufficiently small in the diameter to bear boring and reaming to the standard size.

The spindles in three of these presses were 2″ in diameter, so I had steel sockets made like the one shown in the accompanying engraving, where *A* represents the socket, having a hexagon shape *B*, at one end. The socket was fitted to the spindle *D*, by means of the thread shown by the dotted lines. After being firmly screwed to the spindle, it was put into a steady rest, bored and reamed to the dimensions shown by the dotted lines inclosing *E*.

In one case, the hexagon shape *B* interfered with the spindle, and prevented it from being raised as high as was desired, so, after the socket was firmly screwed to the spindle, the hexagon was turned off. This of course was no loss, as it was forged upon the socket, and not finished.

The slot *C*, for receiving the end of the drill shank, may be made rectangular, or with round ends, as desired. I prefer the round ends, as they are more easily formed. For removing the drills, a key having one flat and one round side is used. One of these keys was chained to each drill press, and any workman caught knocking out a drill with a hammer received a reprimand. Three drills of each of the sizes most generally used, were made, and placed in the tool room. In addition to these, there was a promiscuous lot of counter bores, tit drills and other tools, which had caused so much trouble previously. These could now be used in any of the presses, a convenience which pleased the workmen wonderfully.

Two standard sockets were made of steel and reamed, making exact duplicates of the sockets upon the drill presses. One of these sockets, after being bored and reamed, was bored out $\frac{15}{16}$ inch in diameter, and to the depth of the slot *C* for the flat end of the drill shank. This socket was given to the tool-maker to turn and fit the drills, which were accurately fitted to the taper, and were allowed to bottom in the hole. After this, the ends were flattened by milling to fit the slot *C* in the other standard socket. The slot being 1″ long, the end of the drill was required to enter ¾ inch from the bottom of the slot. This was done to prevent twisting off the ends of the drills, or spoiling the socket.

I have seen both sockets and drills ruined, owing to careless fitting, because the ends were allowed to catch but $\frac{1}{16}$ inch, or less, in the slot. I have found the method described above entirely satisfactory in practice, and, for five years from the time the standard socket was adopted not a single end of a drill was twisted off, neither did the toolmaker need to go to a drill press to fit a drill.

The wear of the standard socket used in the tool room for fitting drills was apparently the same as that of the sockets on the drill presses, so that there was no trouble experienced on that account. I found the system paid for itself very soon, besides affording a great deal of satisfaction.

The most recent invention in transportation matters relates to the conveying of grain in pipes, and is the discovery of a Western man, A. K. Williams, of Minneapolis, Minn. The plan, so far as it has transpired, seems to be the inducing of a rapid current of air through a pipe by means of exhaustion. The induced current is to carry with it the grain at a remarkable velocity. It is claimed that the grain does not come in contact with the sides of the pipe, the denser air on the outside forming a cushion which prevents contact. It is also said that there is no injurious contact of the kernels. Exhaustion pumps are to be used at intervals, it is said, which, unless regular stations are to be made, seems to be the most unreasonable statement in reference to the whole matter.

Moulding Bevel and Spur Wheels in Green Sand Without a Pattern.

By Thomas D. West

Gear moulding is something that nearly every jobbing and machine foundry has something to do with. Gear wheels are often broken in use, and are readily replaced if the patterns are at hand in some foundry near by. But when to replace them it is necessary, as is often the case, to send a good ways, there is generally great delay before the casting is received.

Some mills and factories keep in stock wheels to replace those that are liable to be broken, which is a very good plan, as the expense of carrying a few wheels is trifling when compared with the loss of having a machine, or sometimes the entire works, shut down until a new wheel is procured.

The cut represents a plan for moulding or sweeping up a bevel wheel, the pattern work for which can be made in a very short time, compared with that required to make an entire pattern. The sweeps and segment could be made one day, and the gear cast the next day, unless in the case of a large wheel. The advantages of sweeping up such wheels, where there is only one or two wanted, is the saving of making a full pattern, and the saving in time. Of course, it takes more time to mould a gear with the sweeps and segments than where a full pattern is used, but this extra time is nothing compared with the labor required to make the pattern.

In sweeping up gears in this way the spindle seat is first sunk and trued up, and if the wheel is large in diameter, it is best to have the top of the spindle held firm, by having a brace attached to it. Then a coke or cinder bed is placed as shown, after which the sweep *X* is fastened to the spindle. A bed for the hub *B*, and loose arms *P*, also for the inside face and the top surface of the teeth, is swept up, and at the same time, the joint is also swept. The hub and loose arms are now set on. The surface of the bed, and joint having been well sprinkled and sleeked up with parting sand, the cope is set on and rammed up. When the cope is lifted off, the sweep *S* is fastened to the spindle, having the edge *H* just bearing on the joint, so that when the sweep is revolved it will not disturb it. If the joint is disturbed it will leave a fin over the tops of the teeth.

The depth of the teeth and rim, also the thickness of the plate or web, as well as the hub core print are then swept up. The segment *Y*, having an arm screwed on to it, is then secured to the spindle, as shown, and the teeth are rammed up. The tops or joint, edge of the teeth are better for having some long slim nails pushed through the sand.

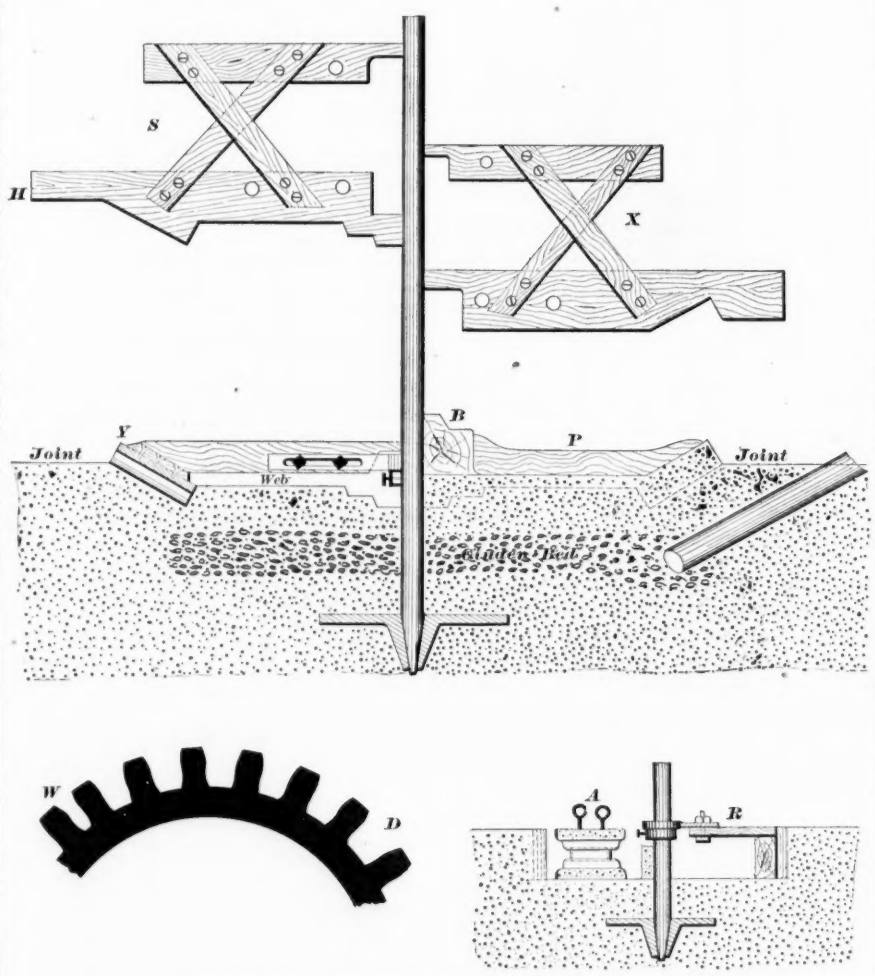
The vents should be carried into the cinder bed, instead of being carried off at the joint, as is generally done when there is a full pattern to mould from. The reason for nailing and venting in this way is that when the cope is lowered down, to see if any of the teeth will crush, if some of them should touch hard, the nails will help to hold them from being broken, or from sticking to the cope when it is hoisted off again. If vented at the top, the fins, of which there will be more or less at the tops of the teeth and at the joint, will be sure to get into the vents; but when carried off through the cinder bed, the joint all around the flask can be rammed so as to prevent any run-outs, and burning the flask.

There should not be less than six teeth on the tooth segment. The more teeth the quicker will the moulder get the teeth rammed up.

Great exactness is required in sweeping up gear wheels after this plan, in order to get the right number of teeth, and also to have the last tooth rammed up of the same width and space as the others. After the bed for the segment to lay on is swept out, it is best to go around with the segment, marking the ends of the teeth on the bed, so they may be counted, to make sure of having the last tooth come right, before starting to ram up the teeth. *W* and *D* show the last tooth, which is liable to come larger or smaller, when the diameter is not set exactly right. When marking off on the bed before ramming up the teeth, should the last tooth be found to leave too large a space, as shown at *D*, the diameter must be made less. Should the space be too small, as shown at *W*, the diameter must be increased.

The amount that the radius is changed to bring the last tooth right, is approximately one-sixth of the measurement that the tooth is too large or small. Should the space be $\frac{8}{8}$″ (or $\frac{4}{4}$″) too large, the radius should be made $\frac{1}{8}$″ smaller, after which it is best to go around again and see if the change has made it right.

The cut *R*, shows the process of sweeping up a spur wheel. A level bed is first made, and then the tooth segment fastened to the arm, which is of different shape than the one shown for sweeping up the bevel wheel. The collar which is for supporting and allowing the arm to revolve around on it, is held firmly by the set screw shown. After the teeth are all rammed up and finished, the dry or green sand cores can be set on the level bed to form whatever style of arms are wanted. The arms are shown at *A*. The spindle is then taken out, the hole filled with sand and



Device for Moulding Spur and Bevel Wheels.

the center core set in. The mould is then ready for the cope to be set on.

The cope should be rammed up on a level mould board, or on a level bed of sand. After the cope has been tried on and off it is then set back, or closed on for the last time. The weights are then hoisted on, and the bars wedged down if necessary. The pouring basin, or runner, and feeding heads are made, after which the mould is ready to be poured.

Referring to the spacing of the teeth in such a way as to come out correctly—that is, with the last tooth and space of the same dimensions as all the others—it is better, after changing the radius as noted above, to carefully impress the teeth on the sand entirely around, and after being satisfied that they are right, then cover up the impressions with pieces of board, paper, or anything that will prevent the marks from being obliterated. In moulding the teeth, instead of using the last tooth moulded as a guide in moving the segment, be guided entirely by the impressions referred to. By this means, there is an absolute certainty of coming out with tooth and space the proper size.

For obvious reasons, if the last tooth moulded is used for a guide, there is danger of having a thin or thick tooth at the conclusion.

Offering Baits.

The following pithy editorial in a recent number of the *Industrial World* so aptly points out a weakness quite frequently exhibited in commercial transactions—one that is creeping into the purchase and sale of machinery to an extent hitherto unexpected—that we copy it entire:

The wisdom of the practice of offering what are called "baits" to customers has frequently been questioned. It not unfrequently happens that it takes a very big "bait" to catch a very small customer, and then, changing the simile, "the game is not worth the candle." Sometimes it even comes to pass that the merchant, instead of catching his customer by means of the allurements of his "bait," is caught himself. This offering some special and showy inducement to a purchaser, notwithstanding the prevalence of the custom is reprehensible on both moral and business grounds. The intention of offering a "bait" is to make the purchaser believe that the merchant will sell him goods at a lower price than a competitor, a thing which offering a "bait" does not and cannot prove. Frequently the "special inducement" is but a convenient cover for marking up other commodities above their current value, the dealer hoping to draw the attention of the trade from the general stock and center it upon a few articles on which he is willing to make an apparent or real reduction. The deception thus attempted to be practiced is wrong, as is all false pretense, and it is needless to say that in most cases it fails of accomplishing the purpose desired by the merchant. Baits are sometimes genuine, but oftener they are spurious. Selling "seconds" at a reduced price is of frequent occurrence, and those not versed in the deception are led to believe they are buying bargains, when in truth they may be purchasing goods that would be dear at any price. A dealer will offer a case of prints at a fraction below the market, and upon inspection they are found to be short length, and of imperfect printing, and, when compared with regular goods, actually dear. So, too, certain dealers may offer nails far below the established card, but, when one comes to examine them, he finds that they are not only in broken lots of undesirable sizes, but are made of poor stock, and such as the regular trade would not care to put into their stores, but some purchaser who is not "up in his business," may be found to catch at this bait and get sold. Thus might we go through the list, and mention seconds in screws, cutlery, tools, tinware, etc., all of which at one time or another are made the subject of "baits" for the trade. It will not be denied that frequently dealers offer regular goods at a reduction, but generally when this happens the purpose of the trader is defeated because the result is usually to make competitors reduce their prices to a level with the cut rate, and then, instead of gaining by such transaction, the merchant has unnecessarily cut down his own and his competitors' prices without obtaining any substantial benefit thereby. The object of transacting business is to obtain a fair profit above costs and expenses. This is a legitimate desire and the purchaser should be willing to accord this right to the dealer. It is a foolish customer who thinks the merchant is doing business for nothing or for glory. If a bait is offered there is a purpose behind the offer and that is to build up a business by indirect means rather than by direct. Buyers sometimes take the bargains offered, and then, for fear of being overcharged on other articles, transfer their trade to competing houses. In such instances, the trader must keenly realize that "vaulting ambition o'erleaps itself."

In rare instances, offering baits proves beneficial to the offerer. If the dealer is fortunate in becoming possessed of a large line of staple goods that he can profitably sell at a less price than his rivals, he may be able to outlast them and thus build up a kind of reputation on these goods, that will bring him in custom, but these cases are rare, and if he have a plucky competitor he will be followed in his cut rates even if such cutting does "draw blood" from the latter.

Offering baits is but little better than throwing good money after bad, and nearly always results in both purchaser and seller being fooled.

Comparison Between High and Low Speed Engines.

By Chas. A. Hague.

II.

In stationary engines, not compounded, the limit of heat economy is evidently reached by the expansion of steam to four or five volumes. In non-condensing motors, especially where the exhaust steam is utilized, in order that the cylinder may be cleared of all possible counter-pressure by a moderately good puff on the part of the released steam, it is good practice, with the average load, to prevent the terminal pressure from falling below five to ten pounds above the atmosphere. From this it follows that the initial pressure should not be carried above 85 lbs. per gauge. In condensing engines, the fact of exhausting into a condenser does not affect the economy of steam consumption in producing the gross horse power, and therefore the ratio of expansion should remain the same as above; but the initial pressure should be so proportioned that the terminal pressure may fall just to the atmosphere. By this, the full pressure due to the vacuum on the exhaust side of the piston will be realized, and the percentage of power expended in maintaining the vacuum will be the least possible.

Taking the position then, that a materially higher initial pressure than that above named, will, in a single cylinder engine, act to increase cylinder condensation by raising the ratio of expansion, and will release the terminal steam in an extravagantly moist condition; the conclusion is, that the engine should be constructed to operate under the conditions above mentioned to obtain the best results. In the light of the foregoing we have only to consider the engine as a machine, with its main working parts subjected to strains and friction, as they play the part of a medium through which the energy of the steam is transmitted to the belt, and this at a steam pressure which practice has demonstrated can be utilized in a large majority of cases with smoothness and precision, without calling very extensively upon the momentum of reciprocating parts moving with excessive rapidity. The principal question then is: Of what proportions and at what speed will this medium most economically, as a member of a machine, do the work? The correct answer to this question will cover all grounds pertaining to interest upon first cost.

It is pretty safe to state broadly, that in a machine where heavy masses are reciprocated under great pressure, that with any certain definite strain, the slower the motion can be made possible, the greater the chances for durability. In following up this path with reference to the steam engine, it is evident that it will not pay to increase the motion beyond a point demanded by practical steam-engine economy, for the momentum depended

upon to supplement the small light balance wheel in high speed engines,—a force acquired by the rapid motion of heavy reciprocating parts—is a potent enemy to the stability of the machine whenever the average attendant shall fail to preserve the necessary nice adjustment of the valve gear. It not being clear that steam economy lies in the direction of short cylinders and high rate of revolution, the uncalled for danger and expense of going to extremes, in placing large powers in small compass for general stationary practice, is evident.

It must be acknowledged, however, that there are situations in which imperative demands must of necessity ignore results, which, however desirable, need to be sacrificed. The locomotive must embody great strength and compactness, and be contained within certain bounds; let fuel and repairs amount to what they may. The rolling-mill engine under some conditions leaves no choice but rapid revolution; although there are features which I shall refer to further on, in which the typical long stroke engine excels even in this situation.

For driving dynamo-electric machines, the high speed engine is well adapted, where the power demanded is moderate; although the steadiness of speed necessary to the duty of electric lighting is not found in all high speed motors by any means, and this, not simply because they are turning a rapid wheel, but because the type of valve gear and regulation peculiar to such engines, possess inherent characteristics that produce detrimental effects instantly detected by means of the light. The intermittent long and short flashes from the commutator of the dynamo machine, is pretty plain indication of unsteady speed, and these evidences may be often found with high-speed engines from good builders running at 250 revolutions per minute. The short but clearly discernible vibrations of the regulator, corresponding in some cases to every revolution of the engine, indicates when the "balanced" valve crosses the port. The sensitiveness of engine governors is of two general types, viz.: weak sensitive, wherein the response to demands is quick as a flash, but overdoes the matter; and strong sensitive, wherein everything is held under firm control, the response being equally quick, but just to the point and no further.

The cars for the railroad system of Naples are to be on the American plan.

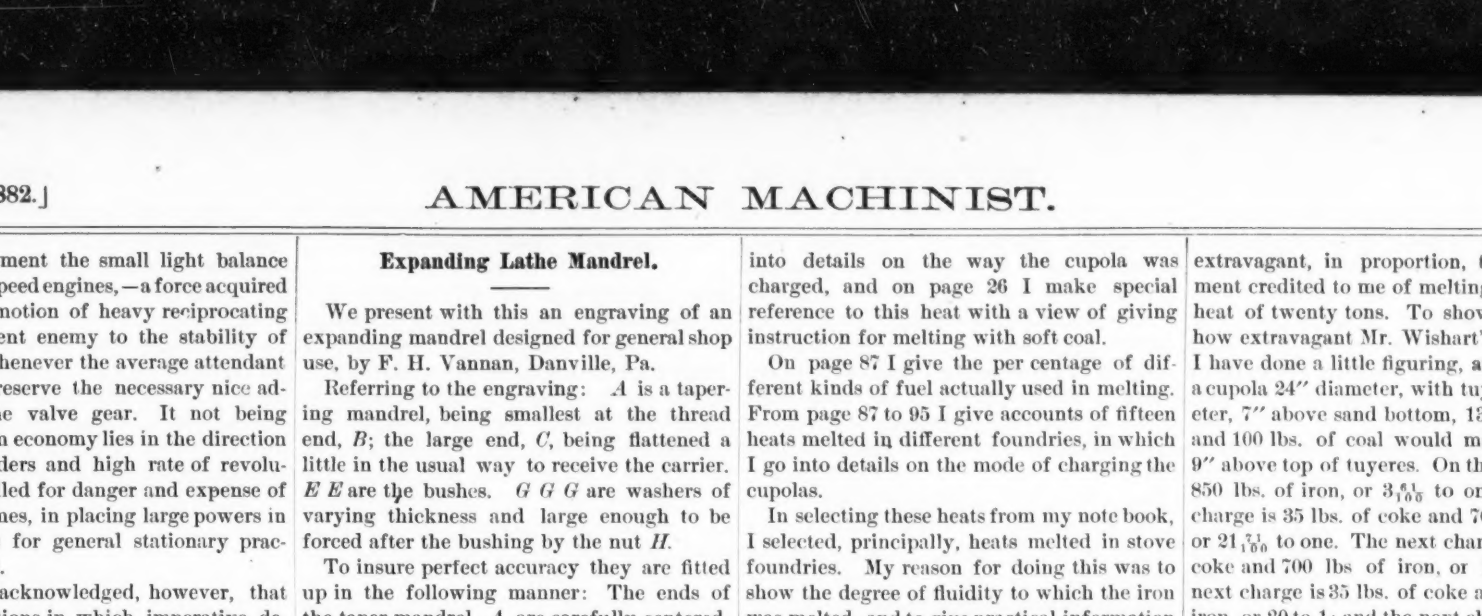
Expanding Lathe Mandrel.

We present with this an engraving of an expanding mandrel designed for general shop use, by F. H. Vannan, Danville, Pa.

Referring to the engraving: *A* is a tapering mandrel, being smallest at the thread end, *B*; the large end, *C*, being flattened a little in the usual way to receive the carrier. *E E* are the bushes. *G G G* are washers of varying thickness and large enough to be forced after the bushing by the nut *H*.

To insure perfect accuracy they are fitted up in the following manner: The ends of the taper mandrel, *A*, are carefully centered, turned and chased, to receive the carrier and the nut, *H*; the bottoms of the centers are drilled to receive oil and prevent injury to lathe centers; the ends are then hardened to prevent wear and injury through carelessness; the body is then turned to the desired size and taper. The bushes are first bored to the exact taper of the mandrel, and large enough to fit half-way between the points *B* and *C*. They are then forced on the mandrel and turned to the required diameter. The diameter is then stamped on in as many places as there are to be sections. They are then cut in sections and the sharp edges on the inside are rounded off to prevent injury to the mandrel in case of a slip, through careless usage.

Fig. 3 is a section of one of the bushes. Fig. 2 shows bushes with different diameters on the same bush.



EXPANDING LATHE MANDREL.

LETTERS FROM PRACTICAL MEN.

Fast Melting.

Editor American Machinist:

On page 102 of my work, "The Founding of Metals," I give an account of two heats melted March 24th and 25th, 1876, with a view of ascertaining the iron lost in melting. In one of these heats the loss with limestone flux was 4 7/10 and in the other with my flux the loss was 2½ per cent. These two heats were melted with soft coal from the Wilkesbarre coal region, and no more coal was used than was actually necessary to make hot iron with that quality of coal. This fact is plainly shown by the percentage of iron lost in melting. Had there been any more fuel used than was necessary, the iron would have been melted slowly and the wastage much greater.

On page 90 I give an account of another heat melted in the same foundry, with the same quality of coal. In this heat I went into details on the way the cupola was charged, and on page 26 I make special reference to this heat with a view of giving instruction for melting with soft coal.

On page 87 I give the per centage of different kinds of fuel actually used in melting. From page 87 to 95 I give accounts of fifteen heats melted in different foundries, in which I go into details on the mode of charging the cupolas.

In selecting these heats from my note book, I selected, principally, heats melted in stove foundries. My reason for doing this was to show the degree of fluidity to which the iron was melted, and to give practical information to all; for iron melted fluid enough for stove plate could easily be tempered in the ladle to suit any kind of work; while, iron melted in the majority of machine and jobbing foundries could not be used at all for stove plate, bench work, or for any kind of light casting.

In machine and jobbing foundries the castings produced are of such a variety of thickness that it is not necessary to melt iron of an even temperature throughout the heat, and very little attention is paid to the charging of the cupola. In over a hundred foundries of this class in which I have melted iron, I did not find one in twenty in which the practice of correctly weighing the iron and fuel when charging the cupola, prevailed. The common practice is to count the shovels of fuel, and to count the pieces of pig iron, and guess at the amount of scrap.

In this way of melting neither the foundry man nor foreman, has any control of his cupola. The iron is melted at different degrees of heat, which produces castings of different degrees of hardness, and there is always trouble with hard iron.

In all my publications I have not aimed to excel all others, but to give to the foundryman something practical on the melting of iron. I am not the author of the statement credited to me in Appleton's Cyclopædia, in which I am credited with melting a ton of iron with 120 lbs. of coke, and I have never seen iron melted hot enough for light work with less than double that quantity of coke; but I have seen better results than this last mentioned produced where large heats were melted for heavy work.

Mr. Wishart, who in your issue of Feb. 18 sets himself up as a critic of all the works published on melting iron, makes the most extravagant claims I have ever seen published. He claims to have melted 9¼ to 1 in a heat of less than two tons. This is far more extravagant, in proportion, than the statement credited to me of melting 16 to 1 in a heat of twenty tons. To show your readers how extravagant Mr. Wishart's statement is, I have done a little figuring, and find that in a cupola 24″ diameter, with tuyeres 4″ diameter, 7″ above sand bottom, 135 lbs. of coke and 100 lbs. of coal would make a bed just 9″ above top of tuyeres. On this bed he puts 850 lbs. of iron, or 3 61/100 to one. The next charge is 35 lbs. of coke and 760 lbs. of iron, or 21 71/100 to one. The next charge is 70 lbs. of coke and 700 lbs of iron, or 10 to 1. The next charge is 35 lbs. of coke and 700 lbs. of iron, or 20 to 1; and the next charge is 35 lbs. of coke and 850 lbs. of iron, or 24 25/100 to one.

With the bed only 9″ above the top of tuyeres, and a No. 5 Sturtevant fan run at the proper speed, not a pound of iron could be melted in the cupola described by him. The iron would be so low it would be struck by the cold blast, and even, if by using a light blast, the first charge was melted, the bed would be so reduced that the next charge of fuel would not raise it sufficient to melt 20 to 1, and the result would be a failure, as Mr Wishart admits his heat was, for he says: "I do not claim this to be a safe working quantity of fuel, but I do claim that 7 to 7½ lbs. of iron should be melted for every pound of fuel." If Mr. Wishart will follow the advice he gives to Mr. West, he will soon find that it is not possible to melt either 7 or 7½ lbs. of iron to the pound of fuel in his cupola, with the sized heat he is running.

EDWARD KIRK.

Good and Indifferent Workmen—Boring Tapers.

Editor American Machinist:

In your issue of Jan. 7th, 1882, you published an editorial on "How Closely Does a Machinist Measure?" There are undoubtedly many machinists in the country who with good tools can work as accurately as in the instance you mentioned, but there are a great many more who do not. The only way many of them can make any kind of a fit is to cut and try, and I believe as a general rule the cut and try men get as high wages as the men who make good fits with certainty.

I believe that the practice of paying the same wages to both good and bad mechanics is demoralizing. There is no incentive for the poor workman to educate his touch up to that degree of delicacy required in doing accurate work, and *per contra*, the good workman often becomes careless and says: "What

is the use; I do not get any more wages than John Gumpwedge who can't work to a blacksmith's hair breadth" (that's ¼ of an inch).

Another thing that is demoralizing to good mechanics is the fact that men who never in their whole life had an original idea; men who can never do a piece of work out of the regular line without consulting the foreman, will frequently get better wages than men who do not know what it is to get stuck on a job. The reason of this is the fact that it flatters the vanity of many foremen to be applied to for explanations as to how some difficult piece of work should be done. Such foremen are frequently jealous of men whose knowledge of the trade is greater than their own.

In your issue of Nov. 12th, 1881, you had an editorial on the subject of the "Individual Advancement of Mechanics." With that article I fully agree, but would suggest that when such a system is adopted, it is absolutely necessary for the proprietors of the shop (if they do not act as their own foremen), to look a little after the men themselves, and also to watch their foreman, and see that he does not by reason of some jealousy or other prejudice, try and keep down some man who knows the trade better than himself.

Here is a little advice which I would give to young journeymen: Try and study human nature. If you obtain work in a strange shop and desire to retain the situation, do the very best work you know how to do. Never *sojer* but attend strictly to business. Be promptly on time. Do your work as quickly as compatible with the accuracy required. Be respectful and accommodating to your shopmates. Do not try to teach them anything which you think may be new to them. If you see them doing a piece of work in an awkward, clumsy and bungling manner do not volunteer any advice; if you do, nine times out of ten, you will make an enemy. Wait till your advice is asked for, or until you have a job of the kind yourself, then do it your own way; and if it prove to be better than the old, your method will be seen and adopted. Especially, never try to advise the foreman how work should be done. If he should direct you how to do a piece of work, listen respectfully and attentively to his instructions, and if you think you have a better method of doing it, you can make the suggestion of your way in such a manner that he will think he has suggested it himself. Use a little tact. Many foremen are exceedingly fond of *taffy*. If the work to be done is something which is new to you, don't be afraid to ask instructions from the foreman; don't assume to know how it should be done and then go to some of your shopmates to find out, for the reason that about nine times in ten, they will try to *josh* you, if you are a new hand.

After I had worked as journeyman for about three years, I obtained a situation in a shop where I was a perfect stranger. The second day the foreman gave me some work which required taper holes to be bored about 2 feet long, and about 5″ diameter at one end and 5½″ or 6″ at the other end. He told me what lathe to use, and what size and taper to make the holes. I cleaned and oiled the lathe, laced the belt, ground the tools, looked over the work in hand and puttered away to kill time till noon. I had never done or seen such a job done, and in my excitement I could think of no method of doing it.

Neither the head stock nor rest of the lathe could be set to a taper, and an examination of the sample piece convinced me that the holes had not been reamed.

After dinner I made up my mind that I was *badly stumped*. There was a genial, jolly looking old man working at the next lathe. I applied to him, told him of my dilemma and asked him how the work was to be done. He told me to "put a ljttle taper oil on the spindles," I replied that I knew of that way of doing it very well, but that I believed there was no more of that kind of oil in the shop; that it had not been in the market since I first went into a shop as an apprentice. He smiled and said "If that is the case why don't you chuck it and use a boring tool?" Thinking that I could get no information on the subject from any of the men, to whom I was a stranger, I applied to the foreman, told him that I was possibly a very poor mechanic to get banked on a job, but if he had any special tool for doing the work, I would be pleased to have him inform me.

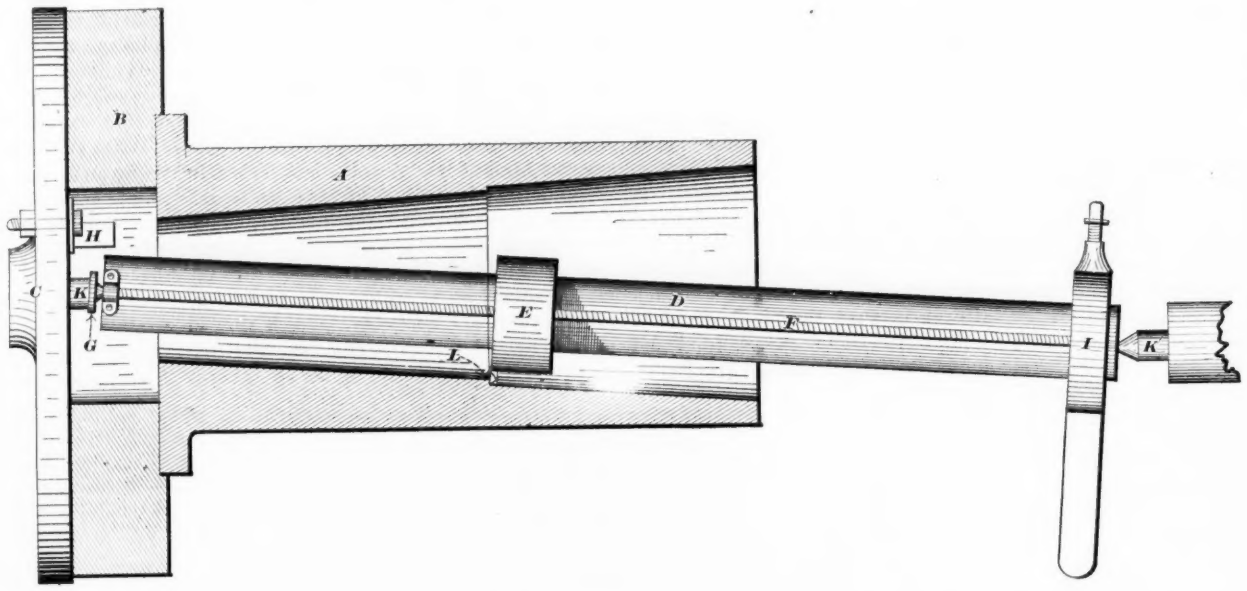
He told me to look under the bench back of my lathe and I would find a boring bar to use for the work, and said: "I will see if you know how to use it, if not, then come to me and I will show you. You are not the first man who has been *stuck* on that piece of work." Upon looking in the place where directed, I found a boring bar, upon which was fitted a sliding collar or head, with a cutting tool let into one side. There was a feed screw the whole length of the bar to which was connected the sliding tool head. On one end of the screw was fastened a star wheel; on the other end was a square head for a socket wrench. After an examination of this "rig" I had no difficulty in seeing how the work must be done, and I did it without making any further inquiries. When I was getting ready to do the work many of the old hands took occasion to come past me to see how I was getting along, but I paid no attention to them. After I was well at work the foreman came around and complimented me by saying, that he had found very few new men who knew how to use the tool without instruction.

I believe this boring bar was original with the foreman, and it was an excellent tool for boring holes either straight or taper. For the benefit of your readers, such as have never seen one, I send you a sketch which will show how it was made and used. In this sketch, *A* is a sectional view of the article being bored, *B* the chuck, *C* the face plate, *D* the boring bar, *E* a sliding head, *F* the feed screw, and *G* the star wheel. *H* is an angle piece fastened to face plate to turn star wheel one point at each revolution, *I*, the dog to keep boring bar from turning, and *K K′* the lathe centers. *L* is the cutter on the sliding head *E*. This cutter should be set so that the cut is on the plane of centers in boring tapers. The head *E* is fitted to the bar with a spline to keep it from turning. If the star wheel has six points with one carrier, *H*, the feed will be ⅛ of the pitch of the feed screw. With two carriers the feed ¼, and with three ½.

This bar can be constructed with a continuous feed by using a gear, in place of star wheel, and another gear matching it, revolving on the end of the bar. So constructed, *F* should be cut with a left hand thread. The difference in size of gears will determine the fineness of the feed.

GEO. B. FOOTE.

Helena, Montana.



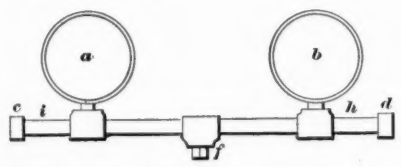
Water Level in Boilers.

Editor American Machinist:

When two or more boilers are connected by one common steam pipe, and water is supplied by one pump, it is sometimes difficult to keep the water at a uniform height in the different boilers. In the AMERICAN MACHINIST of Feb. 11th, Mr. Wm. Gardiner, of Troy, N. Y., gives the correct remedy for this trouble, viz.: An independent connecting pipe, to equalize the pressure.

This equalizer should be at least as large as the steam pipe, and I prefer to place it as nearly as possible over where the water enters the boilers.

At first thought it might not seem that there could be any difference in pressure between the two boilers. But, steam is delivered from a boiler by the force of other steam behind it, and a small opening will admit a greater pressure inside the boiler, than an adjoining boiler with a larger opening can maintain, the steam from the two boilers coming to a common density in the steam pipe.



Difference in size of openings might occur in cutting steam holes in the boilers, or in putting on the fittings, they might get to one side so as to shut off a part of one opening, or the packing might project inside the pipe. With cast iron pipe it would not be surprising to find one piece $\frac{1}{16}$ of an inch under size, and another piece $\frac{1}{16}$ inch over size. This in the case of a 5-inch pipe would make nearly one square inch difference in area, or about .05 of the whole area.

The arrangement of the steam connections has much to do with the relative amount of steam used from each boiler, and the arrangement of the feed pipes has an equally important bearing on the amount of water that each boiler gets from the pump.

In arranging pipes I avoid, if possible, the passing of a column of water, or steam, over an open branch, unless I intend to make a siphon.

To illustrate, I took ¼″ pipe and fittings, as shown in sketch, having the pipe clear and the ends free from the burrs of cutting off; and attached them to two water pails, *a*, *b*, near the bottoms. I did not use any valves, as I wanted a free flow, and no question as to valves being wide open. I used caps *c*, *d*, and plug *f*.

I set the pails level and made marks inside near the top, and at the same height. I then put water in the pails, until the marks were reached.

I then took off the cap *c*, and let the water run. When it had lowered 5″ in *a*, it had lowered only 3½″ in *b*. I closed the pipe, refilled the pails and took off cap *d*. When the water had lowered 5″ in *b*, it had lowered only 3⅛″ in *a*. I closed the pipe, refilled the pails and took out the plug *f*, when the water lowered alike in the two pails, down to the openings. In looking for the cause of the difference between 3½″ and 3⅛″, I found that the nipple *h*, was a little larger than nipple *i*, thus illustrating what I have previously said in this letter, about size of openings.

This demonstrates that water and steam pipes should be connected with opening as shown at *f*.

ANTHON.

Defiance, Ohio.

A Companion to the Odontograph.

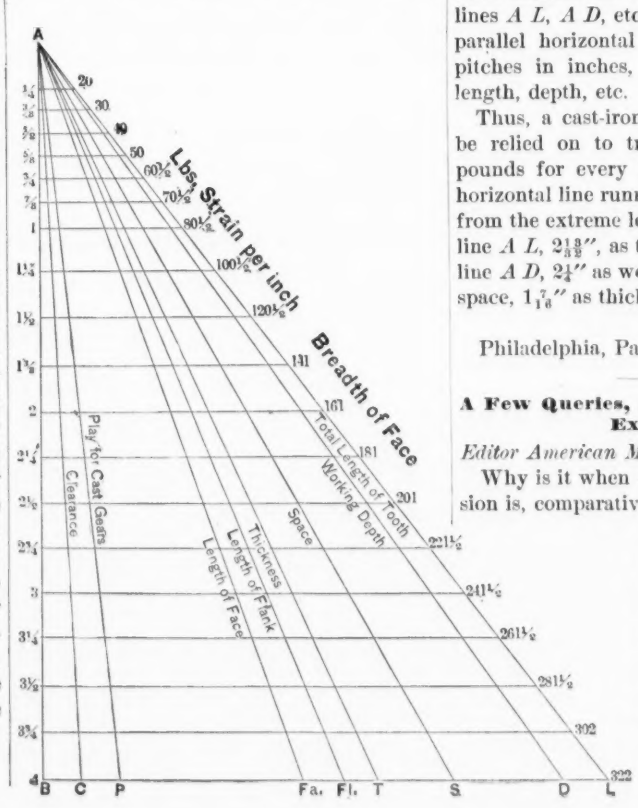
Editor American Machinist:

The annexed scale diagram, slightly modified from Professor Marks' arrangement, is of use in laying out gear wheels, giving the various elements in proper proportion and actual dimensions. Thus, *A B* represents the pitches, ¼ to 4 inches, and the oblique line of figures to the right gives the number of pounds' strain that can be transmitted per inch breadth of tooth face. The oblique lines *A L*, *A D*, etc., serve to set off, on the parallel horizontal lines running from the pitches in inches, the various elements of length, depth, etc.

Thus, a cast-iron tooth of 3¼″ pitch may be relied on to transmit a strain of 261½ pounds for every inch of breadth. On the horizontal line running from 3¼″ we measure from the extreme left to the intersection with line *A L*, 2 1⅜″, as the total length of tooth to line *A D*, 2¼″ as working depth, 1¾″ as the space, 1 7/16″ as thickness, etc.

ROBERT GRIMSHAW.

Philadelphia, Pa.



A Few Queries, and a Hint on Boiler Explosions.

Editor American Machinist:

Why is it when a locomotive boiler explosion is, comparatively, such a rare thing, and a marine boiler explosion, perhaps, a less frequent occurence, that nearly every paper one picks up contains an account of some stationary or portable boiler that has burst (unaccountably of course) at the expense of life and property?

Instead of giving it

up, your answer to such a question no doubt would be: that locomotive and marine boilers are with scarcely an exception under the care of men who have been qualified to take charge of them by a course of instruction extending, generally, over a period of several years, while stationary and portable boilers, especially the latter, are too often left to the management of Tom, Dick and Harry, who perhaps had never been within fifty feet of a boiler until he went there in company with some enterprising "boss," to get the half hour's instruction that would make him an "engineer."

Well; there may be some force in such a reply, but I am inclined to think that if the majority of portable and stationary boilers were made of as good material, as skillfully proportioned, and as well put together as the other classes mentioned usually are, that the number of explosions would be materially lessened.

Intimating that the majority of stationary and portable boilers are of poor quality, cannot reflect on all manufacturers in the country, for there are some who turn out work that could not be surpassed in any respect. The reflection certainly does apply to some of the portable boilers that have come under my notice, where a disposition to be sparing of iron which should have gone into stay bolts, braces, and crown bars, and labor that should have made and put them in was too apparent. If, then, material and workmanship are in the least resposible for explosions, is it not in order to seek a remedy? One could be found too, in the regular publication of the names of the boiler manufacturers, with the account of the explosion.

Allegheny City, Pa. H. E. GOULD.

Center Indicator—Heating for Tempering.

Editor American Machinist:

There has been a great deal said about the center indicator, but, with your permission, I would like to say something more on the subject. A short time since I had to scrape the centers of a lot of head and tail stock spindles, and the thought occurred to me to use the center indicator. I went to work and made the fork piece *a*, as shown in sketch, and applied it as represented.

The indicator was copied after that of C. E. Simonds, in AMERICAN MACHINIST issue of February 4. I found it to work very well.

In your issue of February 25 George B. Foote intimated he would probably say something about tempering taps, reamers, etc. According to his promise, he has done so, but he has not been explicit enough. As there are a great many machinists who do not understand tempering at all, they would not know what he meant by a lead bath, how it is used, whether he heats the steel and dips it into the lead bath, or whether the steel is heated in the lead bath and then dipped in water, or some other preparation.*

Newark, N. J. WM. H. SAUNDERS.

*[We will say, for the benefit of our correspondent, that the lead bath referred to is used for heating the steel.]

Annual Meeting of the New England Manufacturers' and Mechanics' Institute.

The New England Manufacturers' and Mechanics' Institute, has recently held its annual meeting at Boston. At this meeting it transpired that the affairs of the institution were in a most satisfactory condition, a handsome profit having resulted from the first annual exhibition. The following is the statement of the Treasurer, Mr. John F. Wood:

RECEIPTS.

Cash received from capital stock..	$200,000.00
" " (borrowed).....	144,150.00
Profits of exhibition.....	15,544.19
	$359,694.19

DISBURSEMENTS.

Construction account, which includes expenses on land, exhibition building and furniture and fixtures.....	$344,516.66
Rent in full to January, 1883....	5,000.00
Taxes.....	1,959.78
Insurance.....	1,571.09
Cash in hand to balance.....	6,646.66
	$359,694.19

Mr. Wood supplemented his report of the financial standing of the Institute by some able and happy remarks from which we extract. He said:

For the capital stock fully paid in certificates in due form have been issued.

At the meeting of stockholders held last June the Executive Committee were authorized to either issue $100,000 more stock or to borrow the money and issue bonds for this sum.

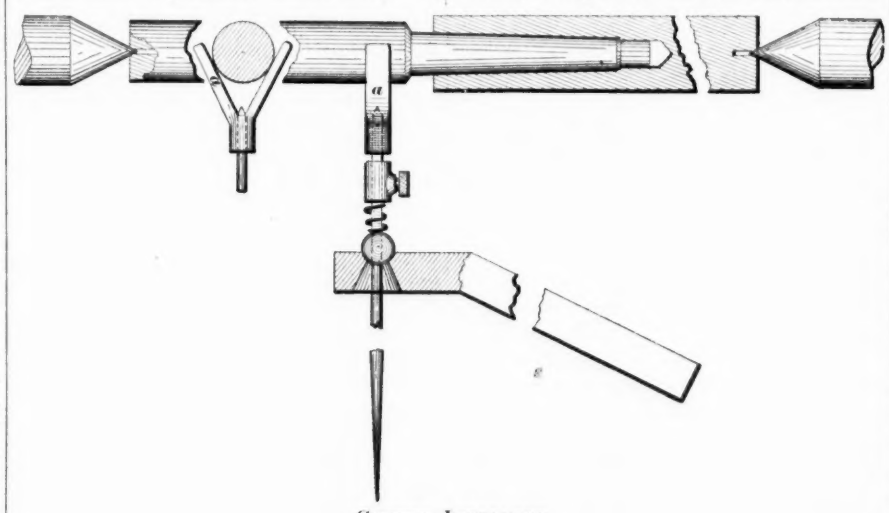
The committee decided that, inasmuch as the money was needed at once to complete our Exhibition Building, it was better to borrow the money, and the treasurer was authorized to borrow $100,000, and issue bonds if necessary. This amount, however, was not found quite sufficient, and authority was subsequently given to borrow an additional amount sufficient to meet the cost of the building, amounting in all to $144,150. This he has done upon the simple promise to pay of the Institute with interest at the rate of five per cent. per annum, with the agreement that if at this meeting you so vote to issue them, simple coupon bonds running ten years with interest at the rate of five per cent., payable semi-annually, will be taken for this whole amount at par.

I need not state to you that this is a very liberal proposition and indicates that this Institution has earnest supporters and well-wishers. And on behalf of the Executive Committee, and at their request, I recommend the issue of $150,000 in bonds. This will place nearly $6,000 in the treasury above the present balance, and enable us to finish the improvements already commenced in and about our Exhibition Building. Our building is rented for the coming months of May, June, and July.

Such is our financial condition. But mere figures do not show what we have done. The question recurs, What have we accomplished by the disbursement shown?

* * * * *

I think we have a right to admire this building and to congratulate ourselves on the short space of time in which it was erected. It bears and has about it no signs of having been built in a hurry. Not a crack or defect is visible in its almost half-mile of brick wall. The heavy snow storms of this winter have not caused the least perceptible deflection of the roof, although the snow was eight feet deep over a large area of it, and allowed to remain until it gradually melted away. It

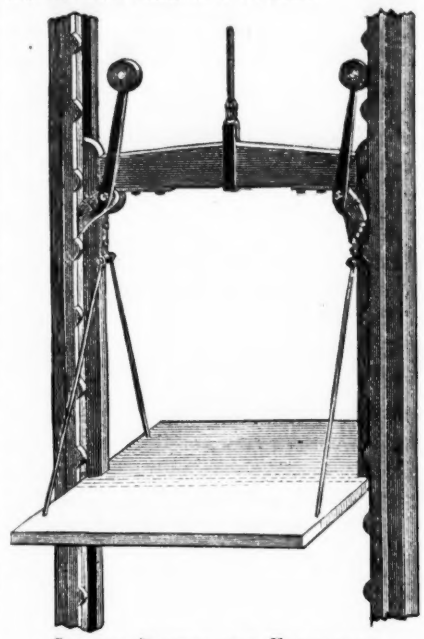


CENTER INDICATOR.

is solid, compact and commodious. It is the largest Exhibition Building in the United States. It is the only Exhibition Building which meets the requirements of exhibitors. The design was to erect such a building as would be adapted to the exhibition of the largest articles and most interesting processes. Look for one moment at the advantages it has for the exhibition of machinery. Where in the United States, or the world, can be found a better place for displaying it? And when we consider what machinery and machines have contributed to the material prosperity of every nation, and of every individual composing every nation, we can estimate what an important item in technical education this advantage is.

* * * * *

The grand thing, comprehending all our other designs, and being in itself the most potential instrument for their accomplishment, was to effect an organization of New England's industrial classes. How to effect that organization has been partially answered. We already reckon a goodly number of men as the nucleus of that organization. But we have not done all that we may and shall do. We have laid it down as a business proposition that such an organization will be the most effective means towards inaugurating, or assisting in inaugurating and carrying on, the improved industrial methods of education of which our people stand in need, and which, in the future, must be provided. This organization is the beginning, too, of an attempt to bring about certain facilities for the advancement of this class of our people, which other organizations accomplish for other classes. In the very first prospectus which we issued an indication of some of these purposes was made. In it we pointed out how convenient and how valuable would be the formation of a mechanical library and of a mechanical museum. In spite of the generous efforts made to supply the want of these, it cannot be said that no more remains to be done.



SAFETY CLUTCH FOR ELEVATORS.

Mr. Wood sketched at length, and in a masterly way, the objects and aims of the association. We are only prevented from giving his remarks entire by a lack of space. Appropriate remarks were made by other prominent gentlemen, when the following officers were chosen for the ensuing year:

Executive Committee—James L. Little, Samuel R. Payson, William B. Merrill, A. D. Lockwood, Providence, R. I.; John F. Wood, Frederick W. Griffin, R. C. Graves, A. L. Coolidge, James H. Work, S. A. Woods, George L. Damon, Edward Kendall, Cambridge; Henry Mason, John M. Little, W. C. Lovering, Taunton; Theodore C. Bates, Worcester; George Crompton, Worcester; Byron Weston, Dalton; William F. Goulding, Lewiston, Me.; P. C. Cheney, Manchester, N. H.; F. C. Kennedy, Burlington, Vt.; Frederick Grinnell, Providence, R. I.; Eben D. Jordan, William E. Barrows, Willimantic, Conn.; F. A. Pratt, Hartford, Conn.—Boston being the place of residence, except where otherwise stated. Treasurer—John F. Wood. Clerk—Frederick W. Griffin.

The East River Bridge.

We learn that it has been finally decided by the trustees that the cars which are to cross the East River Bridge are to be propelled by means of an endless wire cable. They will pass over on one track and return on another, being transferred from one track to the other by means of suitable machinery. It is claimed that by improvements in the manner of attaching the cars to the rope they may be started gradually and without shock, the motion being increased till they attain the speed of the rope, or ten miles an hour. It is claimed that 7,000 passengers can be carried each way in an hour.

It is estimated that $1,250,000 will be required to complete the bridge.

It is said that a Portland (Me.) man has invented an improved machine for turning all manner of irregular forms; the machine being substantially different from anything previously used for the purpose.

A method of compressing fluid steel, for the purpose of making absolutely sound ingots, consists in admitting steam at a high pressure on top of the mould as soon as the metal is poured.

Automatic Safety Clutch For Elevators.

Serious accidents frequently result from the failure of safety devices arranged to arrest the motion of an elevator in the event of the breaking of the cable, or such other derangement of the machinery as would permit the elevator to fall, unless its descent was automatically checked by some means. Much skill and ingenuity has been shown in devising safety appliances for this purpose, notwithstanding which accounts of loss of life occurring every few days, by the falling of an elevator, would seem to be evidence that such devices, or at least some of them, are by no means perfect in their operation.

It is evident that anything used for this purpose must, in order to fulfill the requirements, be not only simple in the arrangement of its parts—depending for its operation upon the least possible complication of pieces and movements—but that these parts must be so arranged as to do away, as nearly as may be, with the possibility of a derangement that shall render them inoperative when a demand is made on them for action.

In the erection of an elevator, it is not of course arranged that the occasion for the operation of whatever is designed to check the fall in case of an accident, shall occur, and the emergency that demands its operation, while liable to arise at any time, may not—probably will not—arise for years; hence the especial necessity for something that shall be free from any tendency to become inoperative through disuse.

The accompanying engraving represents an automatic safety clutch designed by a California architect, Mr. Henriksen, whose present address is at the office of his agent, C. Schwartz, 108 Liberty street, New York. The following description will enable the reader, by the aid of the engraving, to understand the operation of this safety clutch.

The device consists of two cams or eccentrics, provided with teeth along their outer edges, and mounted on a shaft, journaled into a substantial knee brace or bracket, secured to the frame work of the elevator. A vertical lever surmounted by a solid rubber roller, is applied on the same shelf and connected with the cams, to which it imparts a semi-rotary motion. The lever, when in position, is so arranged that the roller will ride along the face of the strip of wood, or cleat, fastened to the side of the guide posts, and provided with a series of bosses or projections spaced about 18 inches apart. The object of this arrangement is to impart a pendulum motion to the levers, when running at the usual speed. When any accident occurs to the machinery, or main cables, that will cause the descending elevator to exceed the regular speed, the impact of the elastic rolls (striking violently against the bosses) causes them to rebound, thereby throwing over the levers and bringing the teeth of the cams against the face of the wooden guide posts. The downward motion of the elevator forces these teeth into the wood, and instantly stops the falling elevator.

It will be seen that there is in this an entire absence of parts that would be liable to derangement, or that would become clogged with grease or dirt, from disuse, and hence refuse to operate when necessary.

We are informed that within one year this device has been the means of stopping four elevators in which were eleven persons.

This Safety Clutch has, among its other good features, the advantage of being readily applied to any description of elevator—old or new—irrespective of shape or make, and without interfering with the "Safety Devices" in present use

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NEW YORK, MARCH 25, 1882.

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Improper Setting of Steam Boilers.

It is very amusing to observe the conduct of a community when the explosion of a steam boiler occurs. Excitement becomes so intense, particularly if any lives are lost, that all sorts of wild propositions are suggested as remedies. Under the press of excitement, bills are drawn up for presentation to the legislature, which is expected to pass the bills in order that they may become a law. Such bills, as a rule, generally contain requirements compelling the application of some patented appliance to steam boilers, regardless of its merits. Other parts require certain regulations and acts to be observed in the care and management of steam boilers, which prove conclusively that the persons who drew up the bills knew little or nothing about the management of steam apparatus.

The result of such a course is, as most interested people know, that the bills are defeated, because of the imperfect and unsatisfactory manner in which they appear.

To properly draw up a bill for the prevention of boiler explosions, a very careful investigation should be made to ascertain the causes of most boiler explosions, with special reference to the varying working conditions which prevail in the several localities. The best and quickest way to reach a conclusion, is to select a number of the best boiler makers and engineers at hand, and consult with them as to the methods which should be adopted in the premises.

There being no law in regard to the setting of boilers, every one is free to set a boiler as he sees fit. As might be expected, boilers are set with the side or end against the brick wall of a building, so that the side or end cannot be reached. If the brick wall happens to be the wall of a basement or sub-cellar, there will be an accumulation of dampness upon the shell of the boiler, which will start a corrosive action, and in a short time render it dangerous. Boilers are often set, resting upon the cast iron front at one end and a pedestal at the back end, leaving them without any support in the middle. As the iron deteriorates along the seams and becomes thinned by corrosion, it is in time very likely to break in two and demolish the premises. We maintain that *all boilers* should be so set that all parts of the shell may be accessible for inspection and repairs, and we have yet to hear a substantial reason why this could not be done. We also believe that all boilers over ten feet in length, should have supports at the middle, instead of only at the ends, as is often the custom.

Boilers could be set more economically, both in the first cost of setting and the use of fuel, if this idea were constantly kept in view. Internally fired boilers should never be bricked over the outside; in fact there can be no good reason why a single brick should come in contact with the shell at any part. It is well known that where bricks and mortar come in contact with iron, there is almost certain liability to corrosion. We have known several cases where internally-fired boilers have been wholly bricked in, except at the front ends; so that their external condition must be mainly determined from inside examination. We have also known such boilers to explode; and when the shell has been carefully examined it has been found corroded so nearly through the sheet that pieces could be easily cut out with a pocket knife.

When a casualty makes the public acquainted with such facts they are loud in their denunciation of the owners, or if there happens to be an inspection law in that locality the inspector has to bear the brunt of their censure. The truth is, they do not consider that, before the explosion, the corroded parts either rested upon or were covered by the brick work so that no person could reach them for examination.

Externally-fired boilers are often all bricked in, top and bottom; then, if required, the inspector is called in and requested to examine or test the boiler, and make out a certificate. He accordingly goes through the form, but we wish to ask in all soberness: What does such an inspection amount to? Can an inspector give a conscientious certificate for the safe condition of a boiler carrying a stated pressure of steam, unless he has made a critical examination of every part? He has to trust to his judgment, and unless he has more than the average of this essential quality in an engineer and boiler inspector there is great risk incurred.

We saw an exploded boiler some months ago in which the iron appeared to be good. It was stamped as the best; specimens were taken from the ruptured sheets, which, in testing, stood a tensile strain of 48,000 and 50,000 pounds to the square inch of section. But these tests did not show the fact, that, in the same sheet from which the specimens were taken, there was a badly channeled seam, and the sheet was less than a thirty-second of an inch thick, being corroded where it had been in contact with brick work.

Test pieces taken from boilers are usually taken from the heart of the sheet, and are not fair examples of the iron in the boiler. Some engineers have placed the life of a boiler at seventeen years, and others at twelve. We are convinced that no general rules will cover the requirements safely, as some boilers are rendered unsafe in a very few years. A thorough system of frequent inspections will be a great deal more satisfactory.

What is wanted as one of the most essential safeguards against boiler explosions, is a law requiring a boiler to be set, so that all parts may be accessible for examination. The top of a boiler may be covered with felting or with a sheet iron jacket having air spaces, as is done already to some extent, and with more economical results. When it is desired to inspect the boiler, the covering can be quickly lifted and replaced, involving no expense for repairs.

Until boilers are made accessible, and are properly and thoroughly examined, we may expect to hear of frequent boiler explosions.

Memory vs. Memorandum.

It is related of one of the oldest and ablest of American mechanical engineers, still in active business, that in his younger years he used to instruct his junior associates and helpers as follows: Never tax your memory with anything regarding which a memorandum can be made.

To those who know him now only a glance at his hale frame and cheerful face is needed to prove that the maxim above stated has brought into his life both success and sunshine.

No more common error can be found in many establishments than the attempt to do with countless business details what no mechanic would think of doing with machinery details, namely, to depend upon memory and word of mouth, instead of upon pen or pencil, for the comprehensive record of what has been and is to be done, that is needed for either rapid or economical handling.

The proprietor or superintendent, or the ambitious youngster who looks forward to being either, will find the acquisition of a correct habit in this direction a potent factor in his future usefulness. Practice makes perfect in the art of memorandum-making, as in most other things, while the habit of depending wholly upon memory becomes with time more and more fatal to the correct and systematic dispatch of business. The proprietor or superintendent who attempts to direct varied and varying work without noting down, as orders are given, the fact that this, that or the other order has been given, must take the risk of failure upon the part of his assistants to comply properly, or to report properly, and is all the time liable to meet some unexpected hindrance or delay sufficient to disarrange all his plans. The memorandum would have been constantly before him, and would have furnished a basis for the timely inquiry which would have rendered such disappointments much less likely.

Of course no memorandum can take in all the details of daily business, or lay down an invariable path to be pursued, without reference to the unforeseen contingencies that are liable to cause variations from time to time, but allowance can be made for such variations more easily with a memorandum system than without.

Noting future engagements and plans in a common dated pocket diary, and forming the habit of consulting this book daily, is also a simple method by which loss and disappointments may often be averted. Of course judgment and common sense must be used in any of the affairs of life, and it is to enable the thinking qualities of a man's mind to emancipate themselves from the mere drudgery of remembering, to the advantage of solid thinking, that the memorandum-making habit is especially desirable. No man who has long tried either the memorizing habit, or the habit of relying upon memoranda, can fail in time either to perceive in his own health and spirits, and the ease and certainty with which he does his work, or to show to those around him, the ill effects of the one, or the good effects of the other. More men are worn out by worry than by work. Holy Writ enjoins us to "take no thought for the morrow," and for any one who really wishes to reach that happy frame of mind, we know of no better means than the smoothly-working system which enables us to take less thought of to-day.

The president of the American Society of Mechanical Engineers has appointed Lycurgus B. Moore, the former treasurer of the society, to the place in the Finance Committee held by the late Alexander L. Holley. The appointment has been accepted, taking effect March 7th, 1882.

Begin Somewhere.

Young men—boys—frequently ask where they can find an opportunity to learn the machinists' trade in some large, first-class shop. This is usually a difficult question to answer, as every one would like to answer it—that is, in a manner satisfactory to the inquirer. As a rule, large manufacturing establishments are taking but few apprentices—many of them not any—and usually they have more applicants for places in a month than they are disposed to make room for in a year.

In many instances—the majority of them—the inquiry has reference to some particular kind of shop, as where marine engines, or locomotives, or stationary engines, etc., are built.

There are no objections to a young man exercising a choice in the particular kind of shop in which he shall—popularly speaking—learn a trade, but it may be suggested that, when he wastes much time in endeavors to find an opening in some particular shop, he not only makes a mistake, but hardly knows what he really wants to do. In the first place, he does not, or at least he should not, want to learn to build marine, or locomotive, or stationary engines, specifically, at all. He does, or should, want to learn to bore, and turn, and plane, and chip, and file the metals that enter into the construction of all kinds of machines and machinery. These processes, together with others, and together with skill and tact and the general knowledge connected with them, go to make the skilled mechanic, and are all there is of the trade of the machinist. They sound homely, and they are homely, compared with what they produce—the finished machine; but they, the homely processes, and not the beautiful machines, are the objective points. This being so, it is a matter of comparative indifference where this skill, and tact, and knowledge are obtained; that is, whether it is in a shop that employs ten or five hundred men, and whether steam engines or something else is produced. The skill that enables the operator to properly turn a saw-mill crank in one shop, will enable him to turn a steam-engine crank in another shop. It is the skill to turn either or both of them, or something else, but neither specifically, that is wanted.

We by no means say that our large machine shops, some of them at least, are not good places in which to acquire so much of the rudiments of the machine business, as a boy is able to master in three years' time, but that they are not necessarily nor generally

better than many smaller and less pretentious ones. In large manufacturing establishments much of the work is done by machines, especially designed with reference to relieving the operator of as much responsibility as it is possible to do, and to be relieved of responsibility is exactly what a young man learning the trade of the machinist should not look after.

The work in establishments of this kind that represents the high individual skill of the mechanic, is usually done by those whose years at the business covers the time of three or four apprenticeships.

The best advice we can give to young men who ask such questions is, not to spend time in fruitless endeavors to get into some shop of especially high reputation; but if you are anxious to qualify yourselves to build such machinery as is made in shops of this class, begin to learn some of the processes of the trade, wherever you can find an opportunity to do so, with the full assurance that when you perfect yourself in them you can take the knowledge with you into any shop and it will pass current. The skill that enables a mechanic to do good work is never at a discount, and those who are looking for that skill never inquire where it was obtained. If you don't acquire that skill in the best shop in the country, the fact that you worked three years in that shop will not help you to any extent whatever.

It is not to be understood that it is not generally better for a man to follow that particular branch of any trade towards which his inclinations may lead him, but three years in a machine shop is not sufficient time in which to pick up more than a few of the rudiments that are entirely common to any and every branch of the business, and it does not matter much in what respectably decent shop this is done. In the machine business, as in most others, grand results are made up by the piecing together of homely little processes, an intimate acquaintance with which constitutes the mechanic. More is known of these homely processes in the poorest little shop in the country than the smartest of boys will be likely to learn in three years. To do *anything* it is necessary to begin somewhere; if not where we would, then where we can.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(93) T. R., Springfield, Mass., asks: How can I reduce a case-hardened male thread? A. You can probably grind it with fine emery, using a section of a female thread for the purpose.

(94) H.G., London, Ontario, asks: Will you tell me the dimensions and weight of the fly wheel of the high-speed rolling mill engine illustrated in your issue of Jan. 28th? A. The wheel is 10 feet in diameter, with a 6″ rim, 9″ face. The weight is about 4,500 pounds.

(95) H. R., Hartford, Conn., writes: A friend of mine says a boring tool has the greatest tendency to dig into the work when set so that the cutting point is above the center. I say this tendency is greatest when the cutting point is below the center. Which is right? A. You are.

(96) J. K., Brooklyn, N. Y., asks: 1. Where can I get information in regard to an oven for japanning steel? A. We do not know of any book that contains the information you ask for. We think you can learn the best by observation. 2. Is there any better common method of protecting steel than that of japanning? A. Not that we know of.

(97) A. M., Harrisburg, Pa., asks: 1. In grinding a tool to cut a square thread, what is the proper plan for finding the angle to which to grind the side of the tool for clearance? A. Mark with a bevel square and scratch, or pencil, on a piece of board with one straight edge, the angle the thread makes, and then grind your tool to this. 2. What is the meaning of the word Hackenos? A. We do not know.

(98) W. H. M., Rushville, Ind., asks: How much more water can be drawn from a faucet 8 feet, than from one 4 feet below the surface. A. The comparative discharge of water from an orifice at different distances below the surface is in proportion to the square root of those distances. The square root of 4 is 2, and the square root of 8 2.8284; hence the faucet 8 feet below the surface would discharge 2.8284 gallons as often as the one 4 feet below discharged 2 gallons. This is the theoretical comparative discharge under the two heads It is probable that the character of the opening through the faucet would modify the results very slightly.

(99) H. A. S., Charlotte, Me., asks: 1. Can steel castings be made by charging a cupola made for melting iron, with suitable steel? A. Not successfully. The processes for making iron and steel castings differ materially and require different arrangements for melting, etc. 2. Is there any satisfactory way of sticking emery to an iron wheel to grind tools on? A. Not that we know of. 3. Would it not be well for those who work with emery wheels to use respirators? A. Yes, if something satisfactory were devised. 4. Are there respirators for sale that would be useful for this purpose? A. Not that we are aware of.

(100) J. H. S., San Francisco, Cal., writes: I am making a rotating valve for a steam engine which I propose to balance with a steam piston tending to lift the valve from its seat. To what extent can I balance the valve? A. Opinions differ widely on this point. We would suggest that you determine the position of the valve when there is the least pressure towards the seat (that is, at some portion of the stroke it undoubtedly uncovers part of the seat and at an another time there may be steam-chest pressure, very nearly, in one of the ports), ascertain the total amount of this pressure, and then make the balancing piston of a size to remove about ⅔ of it.

(101) E. E. D., Athol, Mass., asks: 1. What circumferential speed will be required to burst a disc of cast iron and one of steel? A. It depends entirely upon the tensile strength of the material. Cast iron probably about 310 feet per second; steel from 3 to 6 times that. 2. Is the following rule for finding the speed correct? It is original with me: Length in feet of a bar of uniform section that will sustain itself, divided by 16½, and the square root of the product multiplied by 32 1-6, equals the speed in feet per second? A. No, not as we understand you. 3. It seems to me that the ends of a bar of uniform section could be run at a higher speed than the circumference of a disc. Is this so? A. We should think not.

(102) G. G. C., Blackstone, Mass., writes: In Roper's Engineer's Handy Book, page 364, under the head, Barometer, appears the following: "When the air is dry and light the mercury in the barometer rises; when the air is humid and heavy it falls." Philosophy says: the weight of the air upon the mercury in the cup sustains or balances the weight of the column in the tube. How then, is it possible for the mercury in the tube to rise when the air is dry and *light*, or fall when it is humid and *heavy*? Does it not rather rise when the air is dry and heavy and fall when it is humid and light? A. Without reference to any other quality of the atmosphere, the mercury rises when the air is heavy and falls when it is light.

(103) G. B. W., New York, asks: 1. Will you please inform me how to calculate the horse power of a steam boiler? A. The term horse power as applied to a boiler has no practical significance. In other words it is a meaningless term. 2. Will you tell me how to find the number of square feet of heating surface in a tube of any diameter and length? A. You can find the square feet of surface by multiplying the circumference by the length. In calculating the heating surface of a boiler tube the inside diameter should be taken. Example: What is the heating surface of a tube, the inside diameter of which is 3.8″, and the length of which is 15 feet. A. The circumference is 3.8″ × 3.1416=11.938″. The length of the tube, 15 feet equals 180″ and 11.938″ × 180″=2148.84″, which is the surface in square inches. This divided by 144 (the number of square inches in one square foot) equals 14.92 square feet, or nearly 15 feet.

BUSINESS SPECIALS.

Transient advertisements 50 cts. a line for each insertion under this head. About seven words make a line. Should be received Wednesday morning.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Presses and Dies. Ayar Mach. Works, Salem, N. J.

Alfred Wilkinson, Expert Tests of Steam Engines and Boilers, 123 N. 4th St., Phila.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

List of Machinists in U. S. and Canada; just compiled. Price $10. A. C. Farley & Co., Philadelphia.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

"To stop leaks in Boiler Tubes use Quinn's Patent Ferules. Address, S. M. Co., South Newmarket, N. H."

Wanted—A good specialty to manufacture on royalty or contracts for staple articles. S. McHenry, Machine Shop, 927 Filbert St., Philadelphia, Pa.

Circulars addressed to 50,000 Steam Users in the U. S. and Foreign Countries, embracing names of the largest consumers of steam power. The J. N. Mills Publishing Co., 165 Broadway, New York.

For Sale—A valuable patent on a Door Butt, by which a door can be adjusted any way you wish. For particulars address, C. H. B,, Post Office box 498 Holyoke, Mass.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Book sent free by the publisher, Jas. F. Hotchkiss, 84 John Street, N. Y.

Important to Brick Makers.—Illustrated Pamphlet of Best Brick Machinery in the World, free. Address E. R. Gard's Brick Machine Works, Baltimore, Md.

"Slide Valve Gears," by Hugo Bilgram, published by E. Claxton & Co., Phila., describes the easiest method known for correctly proportioning slide valves, link-motions and cut-off gears; price, $1.00.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

J. E. Kelley, New Haven, Conn., a roofer of long experience, writes to T. New, 32 John street, N. Y.: Your process for manufacturing Prepared Roofing is perfect, giving entire satisfaction.

"Useful Information for Steam Users." A 100-page *Illustrated Pamphlet*. Contains interesting data on the care and management of Steam Boilers, and rules for engineers and firemen. Engineers everywhere should have this work. Sent for 25 cents in P. O. Stamps. The J. N. Mills Publishing Co., 165 Broadway, N. Y.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. Unbound, three dollars. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

Ealy's "Blue Book,"—Special classified list of Machinists, Machinery, Railway, Engine and Boiler Makers supplies, etc., with financial standing and paying qualities of all dealers and manufacturers. Much more convenient and reliable than any other work of the kind published. We also furnish full detailed written reports. Price $30 to July 1, 1882. The JOHN W. EALY COMPANY, 51 Chambers street, New York or 79 Dearborn street, Chicago, Ill.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

MANUFACTURES.

The Union Boiler works, Peoria, Ills., are erecting a new foundry 40x40 feet.

A new brass foundry has been organized in Ansonia, Conn., with John B. Wallace at the head of it.

The Chilled Plow Company, of Niles, Mich., have purchased a tract of land, and will erect buildings, and purchase machinery.

The Wiley Construction Co., Greenfield, Mass., are setting the boilers at the water works in Gardner, with the Jarvis furnace.

Berton & Nickel, New York, are setting seven boilers in the D. O. Mills building. The boilers were built by the Whittier Machine Co.

The citizens of Fort Dodge, Iowa, propose to raise $11,000 to insure the locating of the Minneapolis and St. Louis railroad machine shops at that place.

A company has been formed at Sheboygan, Wis. for the manufacture of perforated chair seats. The manufactory will be the third of its kind in the United States.

The Pattle Governor Company has been organized at Portland, Me., for manufacturing, using and selling the Pattle steam engine governor, with a capital of $50,000.

Hilles & Jones, Wilmington, Del., are still hard pressed notwithstanding their increase of capacity. They manufacture a variety of special and standard iron working machinery.

The Standard Tool Company, Athol, Mass., have commenced the manufacture of a new combination tool, consisting of pipe-tongs, gas-fitters' plyers and the ordinary flat plyer.

The statistics of Paterson, N. J., silk manufacture for the last year will show that 15,000 persons were employed in the mills, and that $16,000,000 worth of silk was produced.

The Brown & Sharpe Manufacturing Co., Providence, R. I., are more than ordinarily busy in all lines of their regular business. They are melting 8 tons of iron per day in their foundry.

The Electrical Supply Company of Ansonia, Conn. have put up a building 100 feet long and four stories high, have bought their shafting and machinery, and are already burdened with orders.

The Goodyear Metallic Rubber Shoe Company of Naugatuck, Conn., are about to put up a new brick building for use as a machine shop. They have already purchased largely of machine tools.

The Pennsylvania railroad is in want of 50 locomotives, and being unable to contract for their construction as soon as required, has concluded to double its force at the Altoona shops and supply itself.—*Railway Age.*

At Indian Orchard, Mass., the Chapman Valve Company intend to make important additions to their works in the spring. The building will be 100 by 50 feet and three stories high, with a tower 18 by 20 feet, in which a power elevator will be placed.

The Ames Manufacturing Company, of Chicopee, Mass, can deliver no small lathes before the months of June and July, and no large lathes or planers until July to September next, owing to the large orders already placed by dealers.

An association has been organized at Corinth, Miss., for the purpose of Silk Culture. The company propose to raise cocoons from their own trees; also to sell eggs and to reel silk. They have a large farm, and have planted several thousand mulberry trees.

Lodge, Barker & Co., 189 West Pearl St., Cincinnati, Ohio, write us: Our orders more than keep pace with our capacity to fill them. Although we have lately put in four more lathes and have two more planers on the way, which will soon be in operation, we have been and are now making eight days per week.

The Birmingham Iron, Foundry and Machine Co. of Birmingham, Conn., have added to their tools a large Hewes & Phillips planer, several Ames lathes, a National bolt cutter to cut 2½″ bolts, and other tools. They are months behind their orders, and have had to get extension of time on several contracts.

A. M. Powell & Co., began a small machine business about one year ago on Herman street, in Worcester, Mass., employing two or three men. Their business has grown during the year to such an extent that they have recently removed to Union street, where they are employing 50 men on engine lathes, and other iron working machinery.

It is said the profits of the Taunton Locomotive Company for the past year will be about double that of any former year, and will equal about seventy-five per cent. of its capital stock. This establishment is turning out an immense amount of work, and gets nearly twice as much for a locomotive to-day as it did a year ago.—*Manufacturer's Gazette.*

The Derby Bit Co., of Ansonia, Conn., which organized about a year ago, has since that time purchased water privileges, put up buildings for forgings, polishing and machine departments. They are making what is known as the Derby Expansion Bit for wood working purposes, together with small forgings. They are also preparing to turn out a common auger bit of a very superior quality.

The Webster, Camp & Lane Machine Company Akron, have set up a steam engine at their Rubber works which weighs 60,000 lbs. The fly wheel is 18 feet in diameter, and has a turned face for belting, 42 inches in width. The weight of the wheel s 28,000 pounds. This wheel is the largest single piece of casting ever made in Akron, the entire wheel being cast in one mould, and in one piece. It took 1½ hours to melt the iron.—*Beacon.*

Among the new business enterprises in Chattanooga, Tenn., now under way, or soon to be developed, according to the *Commercial* of that city, are, a stock company with a capital of $75,000 to manufacture plows; a stock company with a capital of $50,000 to manufacture stoves; the East Chattanooga Iron Company will erect a blast furnace with a capital stock of about $200,000, and there is also talk of one or two more furnaces being built in the city.

Frank H. Pond, 709 Market street, St. Louis, and 130 West Second street, Cincinnati, writes us that his business, as western representative of the steam pump establishment of Henry R. Worthington, New York, will continue to be transacted under his own name as formerly, but that to avoid confusion, all his *other* business will hereafter be done under the style and title of the Pond Engineering Co., without change in either ownership or management.

The Scott Printing and Folding machinery, manufactured by C. Potter, Jr. & Co., of New York, has been received with such favor that the works of that concern are taxed to the utmost, day and night, to keep pace with the demand. The Scott machines re in use by the following newspapers: Chicago *Inter-Ocean* (2), *Herald* and *News*; Toronto *Telegram* (2), *Mail* (3) and *News*; Montreal *Star* (2); Washington *Star* (2) and *National Republican*; Brooklyn *Times*; Louisville *Courier-Journal* (2); Baltimore *Herald*; Detroit *News* and *Post and Tribune*; Kansas City *Journal* and *Times*; Toledo *Blade* and Providence *Press*.

Mr. Henriksen, the inventor of the Henriksen Automatic Safety Clutch, is now in this city, introducing his device. He is at present engaged in applying his clutches on the elevators in the Belvidere Hotel, the Bennett Building, and E. S. Jaffray & Co.'s stores. He has leased out the right to several parties to manufacture on royalty. Mr. Henriksen is to be found at the office of C. Schwartz his a ent, at 108 Liberty Street, New York. Mr. Henriksen received a silver medal for his invention at the Mechanics' Institute Fair, in San Francisco, and at the American Institute Fair, in New York.

A. Aller, 109 Liberty Street, New York, has just received four of the largest Korting Universal Injectors ever made. Each one is guaranteed to throw 5,000 gallons of water per hour, at a temperature of 150° against a pressure of 35 pounds per square inch. Upon trial at the factory, each of these injectors raised the water 4 feet, threw the required quantity and maintained a vacuum within the apparatus equal to 19″ of mercury. These injectors are each 44″ long with feed water, steam and discharge pipes of 3″ diameter. The injectors are made wholly of cast composition, and of the same proportions as the sm aller sizes. They were made for the new iron steamer Puritan now being built by John Roach & Son, for the Old Colony Line of steamships, and are to be used as boiler feeders. This is the first instance, to our knowledge, of the application of injectors on such an extensive plan for feeding the boilers of steamers, and we await the result of the trial with interest.

Machinists' and Engineers' Supplies.

NEW YORK, March 9, 1882.

The condition of the supply market is fair, on an average. One week business is active and the next will be a little off. Goods of all kinds in the supply line are readily obtained, and all the manufacturers are busily engaged in filling their orders. Prices still remain firm.

W. H. Craig & Co., Lawrence, Mass., have just issued two new pamphlets, one describing the original Craig Hydraulic Governor, while the other contains illustrated descriptions of improved designs, one of which is intended for application to automatic cut-off engines, or for operating the cut-off mechanism of steam engines.

Iron and Metal Review.

The Pig Iron Market continues as last reported. Considerable business is being done in small lots. Prices are unchanged which we quote as follows:

Foundry No. 1 at $26 to $27; Foundry No. 2, X, $24.50 to $25; Grey Forge, $22.50 to $23.50. The market for Foreign Iron continues in favor of the buyer. New arrivals can be obtained at a good deal less than has lately been asked by the dealers. We quote Gartsherrie at $26 to $26.50; Coltness, $26.50 to $27; Glengarnock, $25 to 25.50; Carnbroe, $24.50 Eglinton, $23.50 to $24; Summerlee, $26. Prime Wrought Iron Scrap is easier to buy at $33, prime selected from the yard. Market for Copper dull and barely steady. We quote Lake Superior at 19c to 19¼c. Banca Tin, 29c. Straits and Malacca, 24¾c. to 25c. Australian and Billiton 25⅛c. Spelter, Western, 5¾c. to 5¾c. Refined, 8c. to 8¼c. Silesian, 5¾c. Lead, 5c. Antimony, 13c. to 14⅞c. for Foreign, and 13¼c. to 13½c for Nevada.

WANTED

"Situation and Help" Advertisements, 30 cents a line, each insertion. About seven words make a line. Should be received Thursday morning.

A Mechanical Draughtsman desires re-engagement. Address "H," P. O. D. 38, New Haven, Conn.

Four young, active and first-class pattern makers, steady work and good wages. Address, Alex. D. Cunny, Cincinnati, Ohio.

Wanted—A first-class draughtsman, capable of designing steam engine work. Address, THE WESTINGHOUSE MACHINE CO., Pittsburgh, Pa.

Wanted—Situation as draughtsman and inventor of Marine Engine Work. Good references. Address, A. F. FOGELQUIST, 511 E. 11th street, N. Y.

Wanted—An experienced mechanical draughtsman and pattern maker. Steady employment in a good place for the right man. Address, J. W. P., care AMERICAN MACHINIST.

Wanted—Situation as foreman or as toolmaker by machinist of 20 years experience. East & West references, etc. Address until April 6, "J. H.," Box 2, care AMERICAN MACHINIST office.

Wanted—Three good tool makers who can make tools for brass and iron fittings. Good wages and permanent employment given. Apply in person or by mail to "THE JOEL HAYDEN BRASS CO.," Lorain, Ohio.

Wanted—Foreman for Foundry employing fifteen to twenty hands. Must have experience in engine and difficult cored work. Applicants must give references and state experience in dry and green sand and loam work. Address, A. W. H., Middletown, Ohio.

Wanted—A competent, reliable young man to take charge of a machine shop. One who can fill the place can have an interest in the business, which is established and successful. Good shops, good work and good pay. A rare chance where the man is wanted more than his money in forming a partnership. Also wanted, a good blacksmith and four machinists, competent, reliable men. Address, Olin Scott, Bennington, Vt.

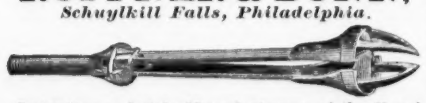
Horizontal Engine, Plain Slide Valve, 20 by 48 for sale. Atlantic Steam Engine Works, Brooklyn, N. Y.

Wanted—Second-hand boiler Punch and Rolls. Address, Sam Griscom, 56 Butler st., Atlanta, Ga.

WE CHALLENGE THE WORLD FOR ITS EQUAL

RUFFNER & DUNN,

Schuylkill Falls, Philadelphia.



Patentees and Sole Manufacturers of the Excelsior Steel Tube Cleaners. $1.00 per inch. Most liberal discounts to dealers. Send for circular.

New Buckeye Engine

FOR SALE CHEAP.

Cylinder 14"x28". This engine has been RUNNING ONLY A FEW MONTHS, is guaranteed to be in perfect repair, modern and equal to any new one. Can be seen in operation at Planing Mill of Lockland Lumber Co., Lockland, Ohio. **Satisfactory Reasons** why this engine was **displaced by one of ours** of about the same size, will be given on application.

DETROIT CUMMER ENGINE CO.

DETROIT, MICH.

WORCESTER MACHINE SCREW CO.

AND 111 LIBERTY ST. NEW YORK

MANUFACTURERS OF

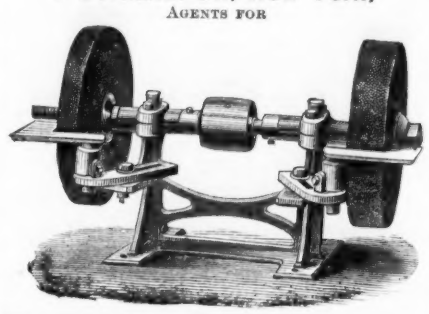
STANDARD MACHINE SCREWS.

COOKE & CO.

(Formerly Wm. Cooke, successor to Cooke & Beggs)

6 Cortlandt St., New York,

AGENTS FOR



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Our wheels possess superior cutting qualities, combined with great durability. Eureka Plow Polisher and Patent Stove Plate Grinders.

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PROFILE OR EDGING MACHINE, Ames' Pattern, *used but very little,* is in good order, complete and ready to use, Price, $450.00

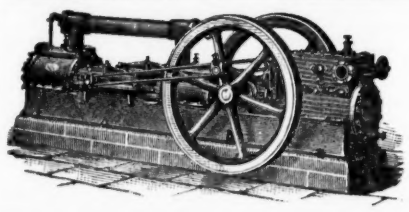
LATHE, 6-foot, Screw-cutting Fitchburg Make, 14 inch Swing, complete, with Friction Pulleys, $225.00.

SAW GUMMER. Covel's Patent, **automatic,** *in good order,* having been *used but little,* $75.00.

DROP PRESS, 80 lb. Hammer, weight 1500 lbs. $75.00. *Address,*

PROVIDENCE SAW & TOOL WORKS,

PROVIDENCE, R. I.



STEAM PUMPS, AIR COMPRESSORS, Friction Hoisting Engines, Vacuum Pumps and Condensers, General Machinery, Steam Engines. Capacity to bore cylinders 110 in. diameter, and turn Fly Wheels of 24 feet.

The Norwalk Iron Works Co.

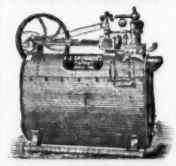
SOUTH NORWALK CONN.

OUR WORKSHOPS,

Factories and Warehouses. Their Sanitary and Fire-resisting Arrangements. By B. H. THWAITE, C. E., with 183 illustrations of the most improved Fire, Sanitary and Ventilating arrangements. 8vo, cloth, $3.50. Free by mail.

E. & F. N. SPON, 446 Broome Street, N. Y.

PORTABLE and STATIONARY ENGINES And BOILERS,



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MECHANICAL DRAWINGS.

Copies or Tracings of any class of machinery made and used in Europe. 2000 designs. **WOOD & RICHMOND,** Mechanical Engineers and Draughtsmen, 176 Broadway, N. Y.

BRADLEY'S CUSHIONED HAMMER

BRADLEY & COMPANY SYRACUSE, N.Y.

Patent Binder for the American Machinist,

$1.00 EACH, BY MAIL OR EXPRESS.

"THE DEANE" STEAM PUMPS FOR EVERY SERVICE.

Send for New Illustrated Catalogue.

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The Deane Steam Pump Co.

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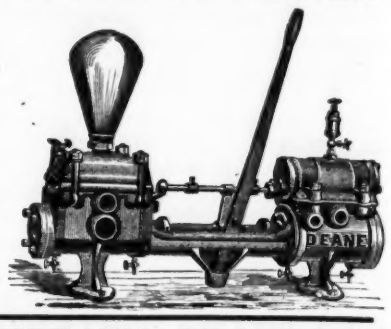
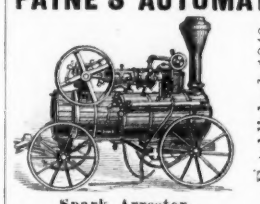


PAYNE'S AUTOMATIC ENGINES,



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Established 1840.

Vertical Portable.

Reliable, durable and economical, *will furnish a horse power with ⅓ less fuel and water than any other engine built,* not fitted with an automatic cut-off. Send for illustrated Catalogue c. c., etc. for information and prices. B. W. PAYNE & SONS,

Box 1230, CORNING, N. Y.

FAIRBAIRN GRATE-BAR

Improved Combustion of Coal and Its Gases.

Saving in Fuel. Burns all kinds. Increased capacity of Furnace. A Ventilated Grate-Bar. No New or Peculiar Boiler Setting. A Simple Device for Economy.

The Fairbairn Manufacturing Co.,

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THE CAMERON STEAM PUMP.

Is the Standard of Excellence

AT HOME AND ABROAD.

THE A. S. CAMERON STEAM PUMP WORKS,

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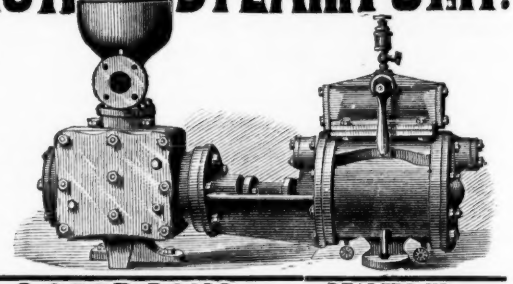

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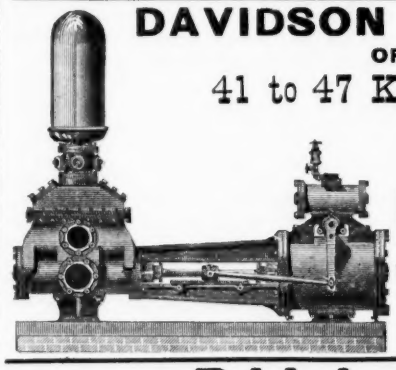

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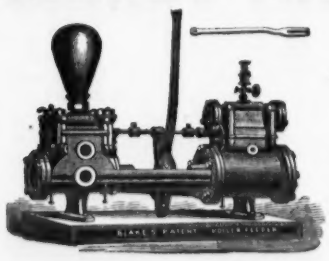

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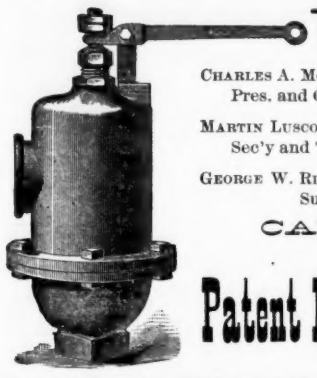

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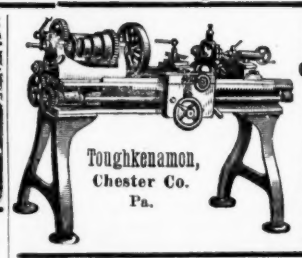

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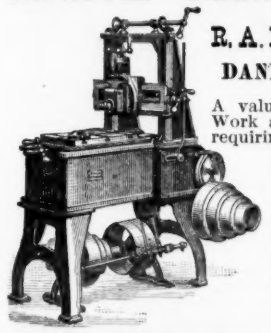

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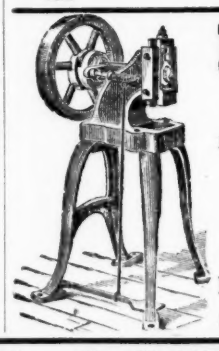

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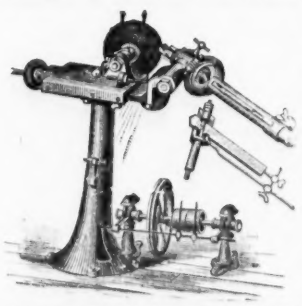

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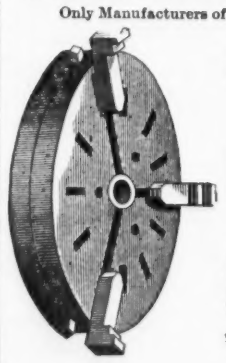

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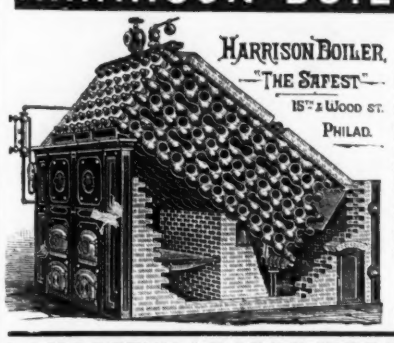

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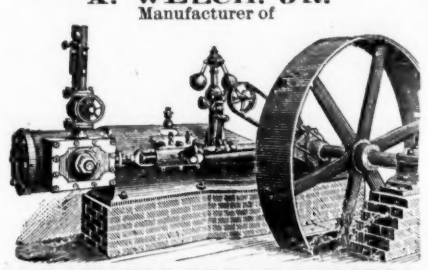

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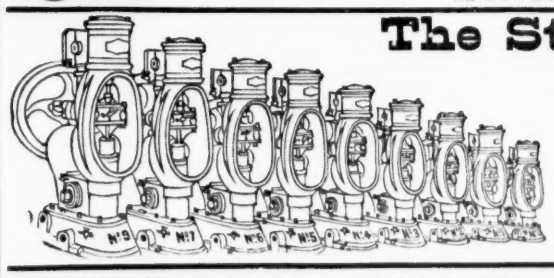

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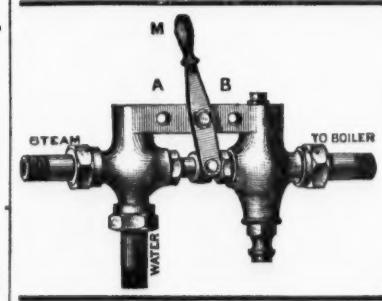

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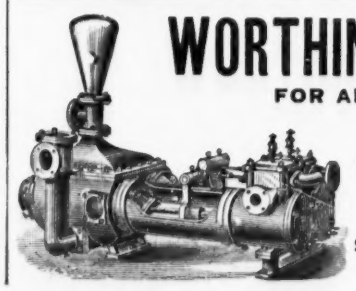

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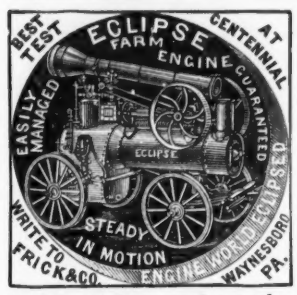

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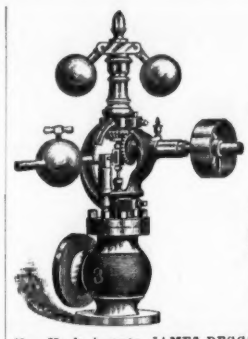

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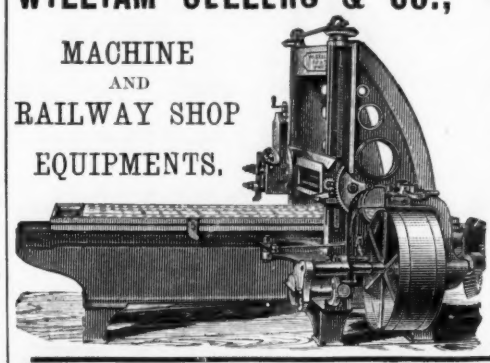

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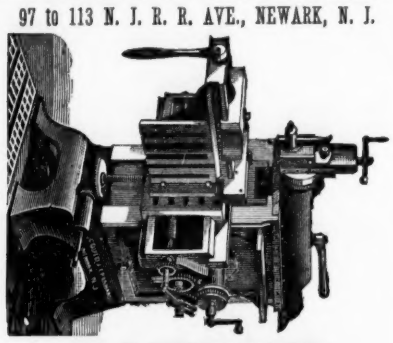

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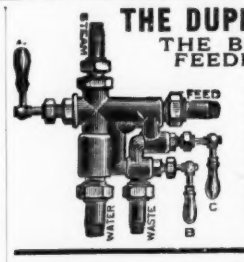

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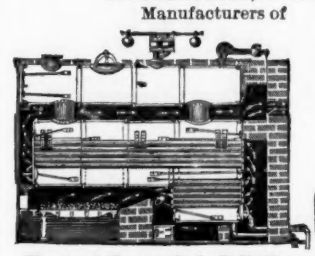

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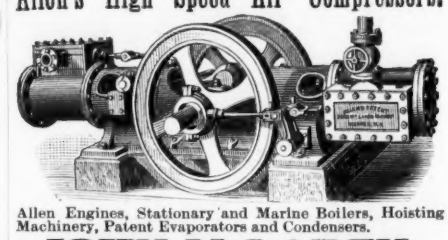

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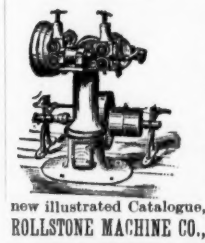

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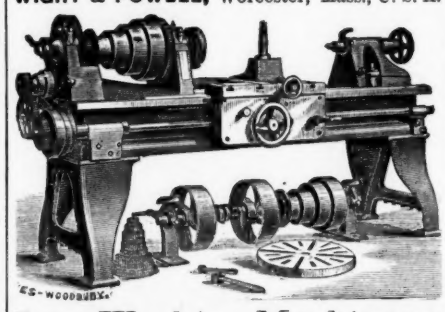

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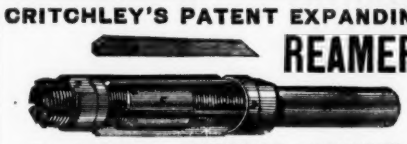

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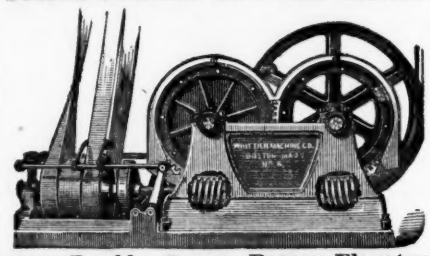

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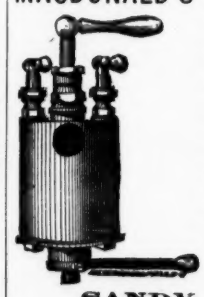

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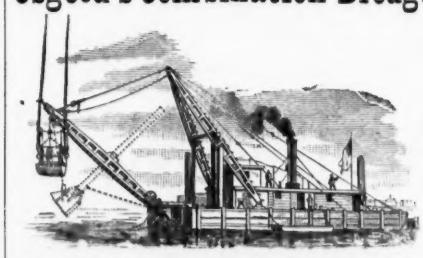

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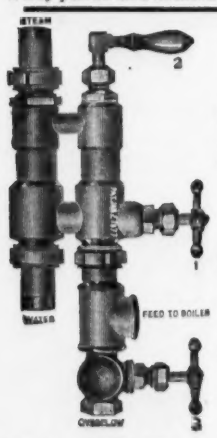

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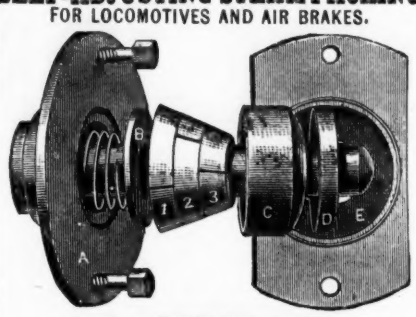

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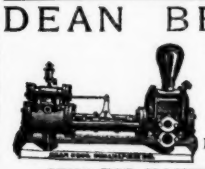

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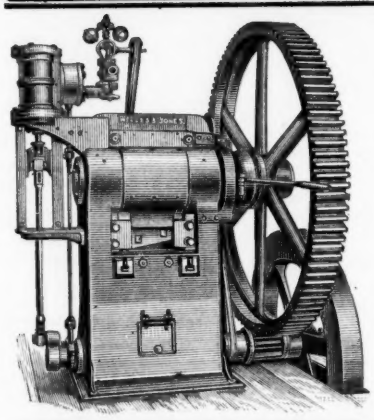

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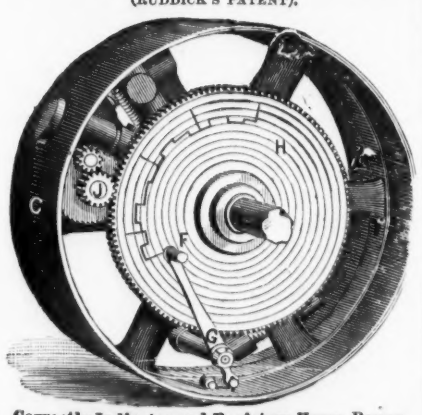

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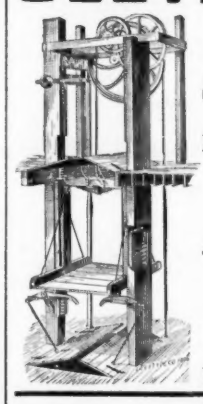

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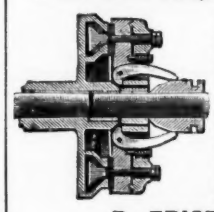

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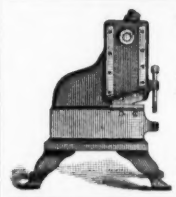

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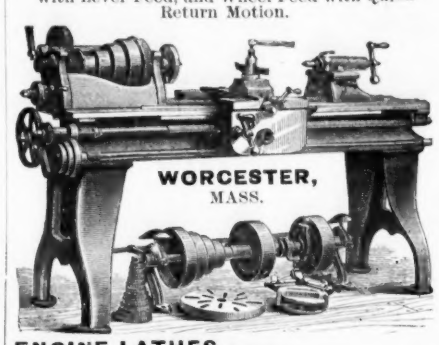

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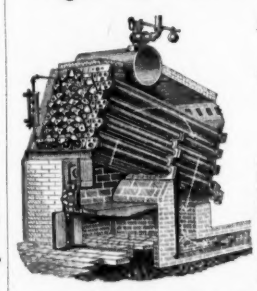

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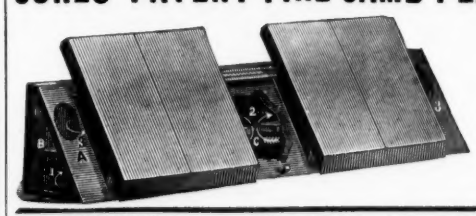

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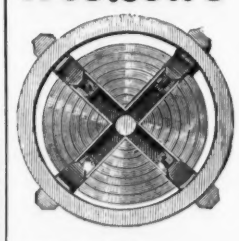

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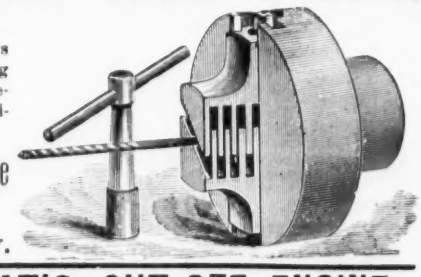

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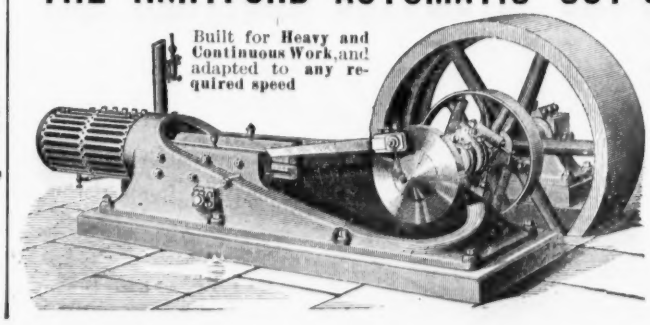

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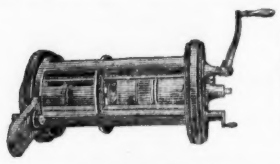

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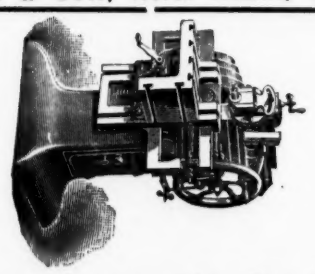

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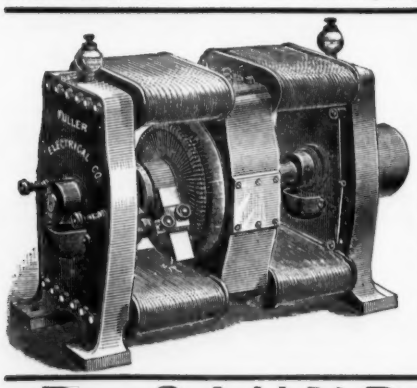

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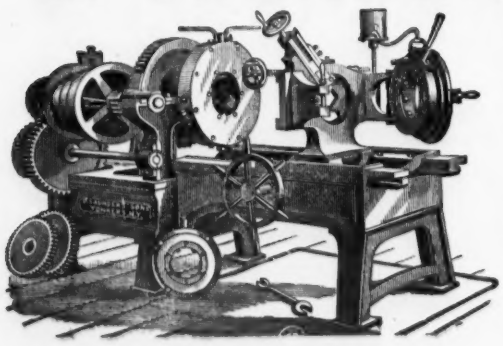

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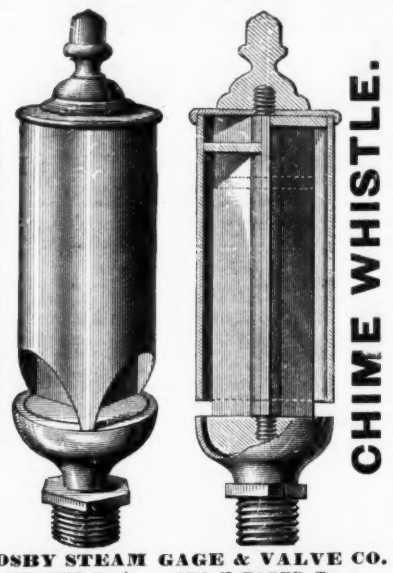

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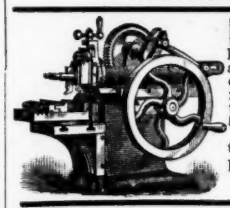

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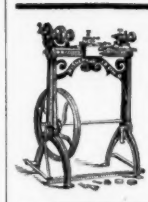

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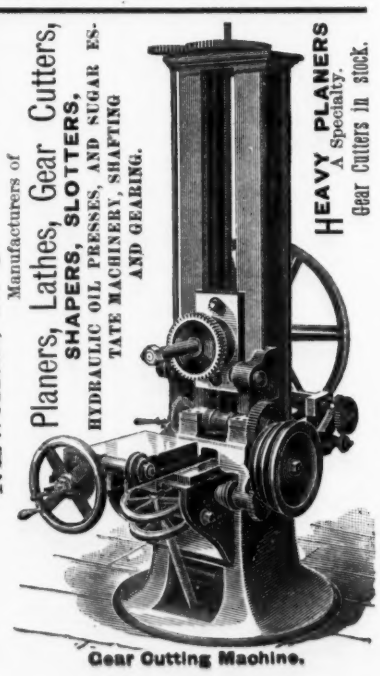

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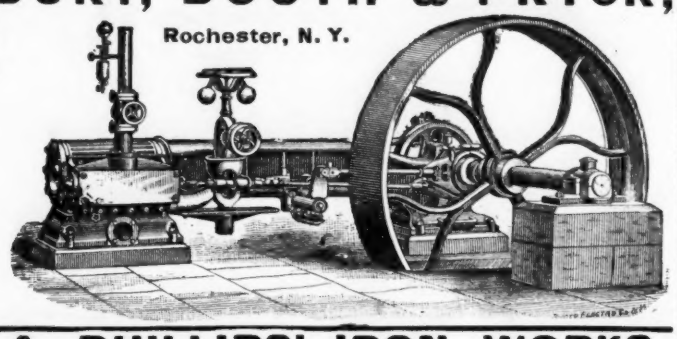

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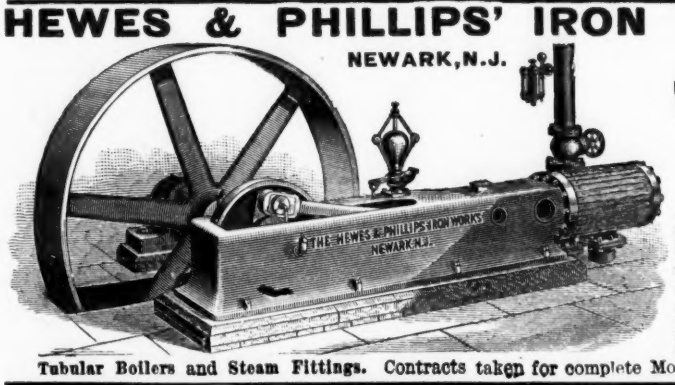

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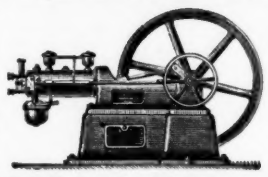

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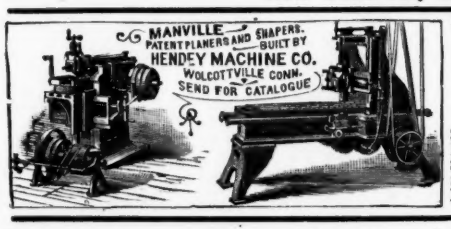

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15 in. Shapers, 24 in. Shapers, 3½ ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 8 ft. x 24 in. Planers, Amateurs' Hand Planers, with chuck and centers, Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck, and Common Clock Lathes. Catalogue gives many names of users of our tools.

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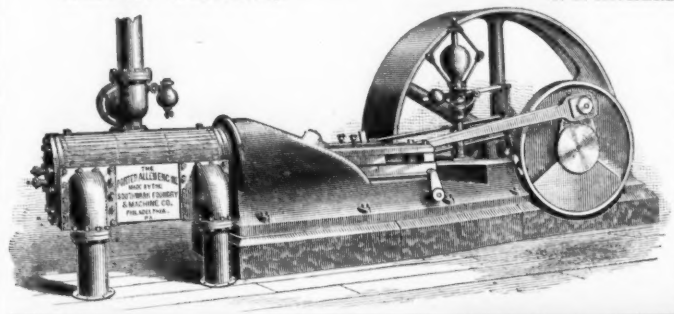

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Orders solicited for Iron and Brass Castings in the rough.

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Differs from all others in having a continuous tuyere. Blast enters fuel at all points, causing complete diffusion of air, and uniform temperature throughout the furnace. Melts 10 to 15 tons an hour with blast pressure required to melt 2 or 3 tons in an ordinary cupola. Gains largely in time, fuel and quality of casting.

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THE ALLIGATOR WRENCH,

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Teeth cut diagonally. Grips Round Iron or Pipe.

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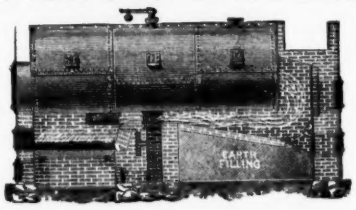

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Second-Hand & New MACHINERY.

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One Car Axle Lathe. Hewes & Phillips. New.
One Engine Lathe, 36 in. x 15½ ft. A1 order.
One " " 28 in. x 16 ft. Fifield. New.
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One " " 20 in. x 14 ft. Fifield. New.
One " " 20 in. x 12 ft. Ames. New.
One " " 20 in. x 10 ft. " "
One " " 20 in. x 8 ft. " New.
One " " 18 in. x 9 ft. Whitc'b. Good order.
Three Engine Lathes 18 in. x 8 ft. Jones & Lamson New.
One Engine Lathe, 16 in. x 6-7-8 ft. Bridgeport Mch. Tool Works. New.
Six Engine Lathes, 16 in. x 6 ft.-7ft. x 8 ft. Ames. New.
One " " 15 in. x 6 ft. Flather's. New.
Three " " 14 in. x 6 ft. Star Tool Co. New.
One " " 14 in. x 6 ft. Hand. New.
One " " 13 in. x 6 ft. Ames. New.
One " " 13 ft. x 4½ ft.
One " " 12 in. x 6 ft. Lincoln.
One " " 11 in. x 5 ft.
One Hand Lathe. 12 in. x 5 ft.. Hendey. New.
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One Planer 18 in. x 3½ ft. Good order.
One " 20 in. x 16 x 4 ft.
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One " 24 in. x 6 ft. Whitcomb. New.
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One 6 in. Stroke Shaper. Boynton. New.
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One 20 in. Stroke Shaper. G. & E. New.
One 24 in. Stroke Shaper. Hendey. New.
One Screw Machine. New Pattern.
One 20 in. Upright Drill. Prentiss. New.
One 24 in. " " Ames. New.
One 30 in. " " Prentiss. New.
One 38 in. " " New Haven. New
One Suspension Drill. Kidd. Good order.
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25 Lincoln Millers and Vises. Good order.
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Large Iron Planer for Sale.

Full capacity of Planer, 26 ft. long; 4 ft. wide; 3 ft. high. For particulars address,

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A GENERAL LINE OF

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NEW MACHINE SHOP TOOLS.

List of Sizes for Quick Delivery.

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13 in. swing, 6 ft. bed. Ames.
14 " " 6 " " Johnson.
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15 " " 8 " " "
16 " " 6 " " Ames.
16 " " 8 " " "
19 " " 8 " " Gray.
20 " " 10 " " Fifield.
20 " " 12 " " "
21 " " 8 " " Blaisdell.
21 " " 10 " " "
22 " " 25 " " Pond.
24 " " 10 " " Blaisdell.
24 " " 12 " " "
26 " " 26 " " Powell.
30 in. swing, 12 ft. bed. Ames.
36 " " 16 " " **Fitchburg.**

IRON PLANERS.

16 in. x 16 in. x 3½ ft. Parker.
20 in. x 20 in. x 5 ft. Hendey.
22 in. x 20 in. x 4 ft. Pond.
22 in. x 22 in. x 4 ft. Powell.
24 in. x 24 in. x 6 ft. Woodman.
26 in. x 24 in. x 6 ft. Wheeler.
26 in. x 24 in. x 6 ft. Gleason.
30 in. x 30 in. x 10 ft. Fitchburg.
32 in. x 32 in. x 8 ft. Gleason.
32 in. x 32 in. x 10 ft. "
32 in. x 32 in. x 8 ft. Powell.
36 in. x 36 in. x 10 ft. Gleason.

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The following New and Improved Machinists Tools are part of what we have for early delivery.

1 36 in. x 36 in. x 9 ft. Iron Planer. 2d-hand. March
2 30 in. x 30 in. x 8 ft. Planers. New. April.
2 26 in. x 26 in. x 6 ft. " " March.
2 30 in. swing, 15 ft. bed. Engine Lathes. March.
1 22 in. swing, 13¼ ft. Bed Engine Lathes. "
5 22 in. x 12 ft. Engine Lathes. April.
3 18 in. swing, 10 ft. Bed Engine Lathes. March.
3 18 in. " 8 ft. " " "
4 11 in. " 5 ft. " " "
2 30 in. " Upright Back Geared Drills. "
2 9 in. Shapers. New. March.

The following on hand:

1 19 in. swing, 6 ft. Bed Engine Lathe. 2d-hand.
2 19 in. " 10 ft. " " New.
2 19 in. " 8 ft. " " "
1 18 in. " 8 ft. " " "
1 15 in. " 5 ft. " " "
1 17 in. " 6 ft. " " 2d-hand.
1 17 in. " 7½ ft. " " "
1 15 in. " 15 ft. " " "
2 14 in. " 6 ft. " " New.
1 12 in. " 4 ft. " " 2d-hand.
1 12 in. " 4 ft. " " New.
1 15 in. " 9 ft. Hand Lathe. New.
1 12 in. " 6 ft. Bed Hand Lathe. New.
1 10 in. " 4½ ft. " " "
1 Boring Lathe, 16 ft. bed. 48 in. swing.
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2 48 in. Swing Radial Drills. New.
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1 21 in. Upright Drill. Nearly New.
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1 3 Spindle Drill. New.
1 6 in. Shaper. New. Hand or Power.
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2 Manhattar Arms Co. Millers. Second-hand.
1 Sellers Milling Machine. 2d-hand.
1 Face Milling Machine. Second-hand.
1 Pond's Double Milling Machine. 2d-hand.
1 No. 2 Screw Machine. New. Turret Head.
1 Screw Head Slotter. Second-hand.
2 Second-hand Profiling Machines.
1 Vertical Centering Machine. Nearly new.
5 4½ in Hyde's Patent Centering Machines. New.
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Lot of Forges 1 Band Saw, 1 Slat Tenoner, 1 Railway Saw Bench, 1 Foot-power Circular Saw, Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in store.

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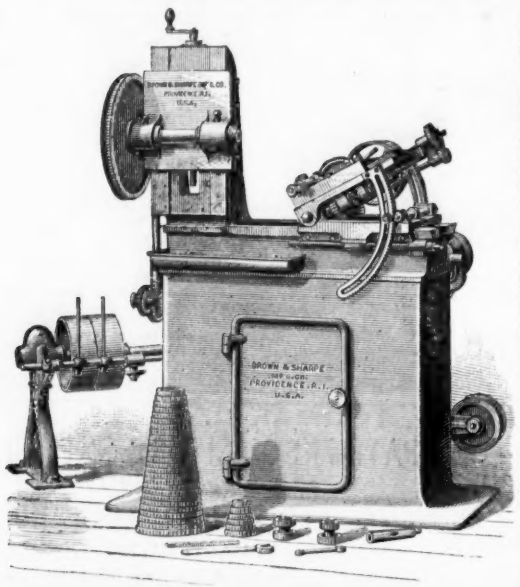

This machine was designed to meet the requirements of Cotton and Woolen Machinery Manufacturers, or others having large numbers of gears to be made. It is arranged for cutting both bevel and spur gears of sizes not exceeding eighteen inches in diameter, three-inch face, and not coarser than six diametrical pitch (about half-inch circular pitch). It is entirely automatic in all its motions, cutting through for each tooth, and revolving the wheel until all the teeth are cut, thus enabling the operator to attend to other work.

The indexing is done by a worm and worm wheel moved by change gears. The blank being put in place and the cutter head adjusted for length of stroke, the wheel is lowered by a screw having a dial reading to thousandths of inches, until the proper depth of cut is obtained, when the cutter passes through the blank and back by a quick return movement; the wheel is then moved the proper distance for the next tooth, and so on until finished. The cutter head is adjustable at any angle for cutting bevel wheels, the degrees being marked on a graduated arc, no other change being required. There is also provision for moving cutter out of center each way, for cutting bevel wheels. A sufficient number of change gears accompany the Machine for dividing all numbers from 12 to 50, and all even numbers to 100, also all numbers divisible by 3 to 150.

A closet in the base of Machine affords a convenient place for cutters, change gears, arbors and wrenches.

Overhead Works are furnished with each Machine, consisting of adjustable, self-oiling hangers, pulleys, shipper stud, stops, etc. Tight and loose pulleys are 10 inches diameter, 3¼-inch face. Countershaft should run 200 revolutions per minute. Weight of Machine complete, prepared for shipment, about 2,000 pounds.

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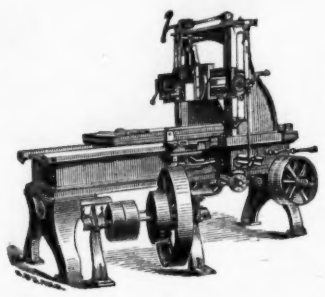

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16 x 16 to 48 x 48 inches square, and various lengths.

ALL FEEDS AUTOMATIC. Send for Illustrated Catalogue and Price Lists.

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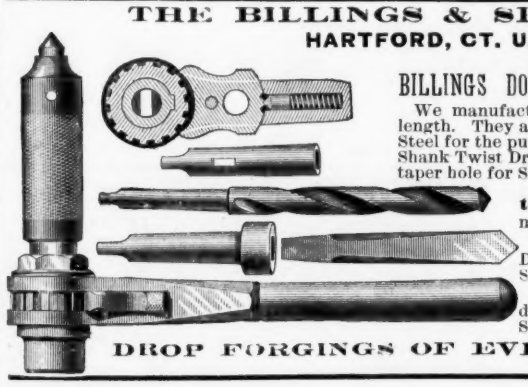

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This Drill can be changed from **Right to Left Hand Drilling** by simply moving the Pawl to right or left.

Price for 10¾" with Socket, to Handle Drills, from ¼" to 29-32" inclusive, and Socket, for Square Shank Drills, $14.00.

Price for 13¾ with Two Sockets, to Handle, Drills from ¼" to 1¼" inclusive, and Socket for Square Shank Drills, $18.25.

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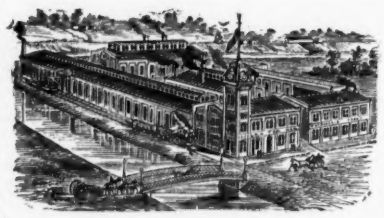

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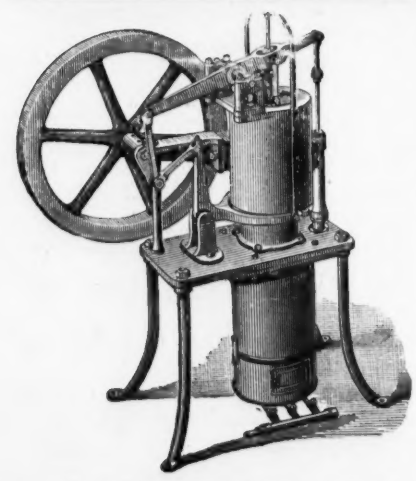

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ENGINE LATHES,

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Immediate Delivery.

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Punching Presses
DIES AND OTHER TOOLS
For the manufacture of all kinds of
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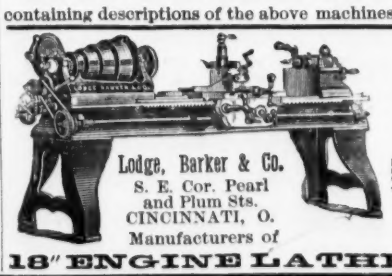
60 FULTON ST., NEW YORK.
Electrical and Intricate Core Work a Specialty.



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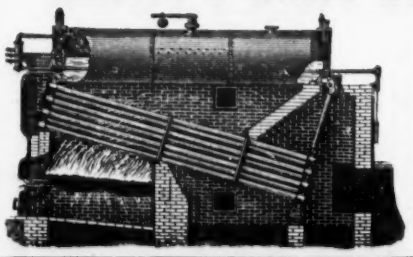

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